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NUCLEAR SCIENCE ABSTRACTS

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ABSORPTION AND SCATTERING OF RADIATION

1233 A Comparison of the Beta-Spectra of C^{14} and S^{35}, by L. E. Glendenin and A. K. Solomon. Physical Review 74, p. 700-701, September 15, 1948.

The investigations yielding absorption curves and Feather analyses for the β-radiations of C^{14} and S^{35} reported by one of the authors in a previous article (Solomon, Gould, and Anfinsen, Physical Review 72, p. 1097, 1947) were repeated. The curves were obtained by observing the activity through aluminum foils of different thickness placed between the source and counter. The absorption curve of the β-radiations of UX_2 was used as a standard in preparing the Feather analyses of the absorption curves. The extrapolated ranges were 28.5 ± 0.5 mg/cm^2 for C^{14} and 31.7 ± 0.5 mg/cm^2 for S^{35}, which are in good agreement with previous results. The shapes of the Feather plots, however, are seen to be identical throughout the entire range, indicating that the shapes of the energy spectra of the two isotopes may be identical. The Feather plots are given.

1234 Proton Stopping Power of Solid Beryllium, by C. B. Madsen and P. Venkateswarlu. Physical Review 74, p. 648-649, September 15, 1948.

The energy loss of protons penetrating beryllium foils of different thicknesses has been determined as a function of the proton energy by measuring the shift of those potentials at which a thin aluminum target gives resonance radiation. The experimental points fit within ± 2 per cent a theoretical curve corresponding to an average ionization energy of 64 ± 5 ev, which is in agreement with a recent theory for the stopping power of metals. Curves are given for the specific stopping power for protons on metallic Be measured with foils of thicknesses 0.222, 0.245, and 0.609 mg. per cm^2.

ASTROPHYSICS

1235 The Effect of Electron Scattering on the Line Spectrum of High-Temperature Stars, by Guido Münch. Astrophysical Journal 108, p. 116-129, July 1948.

In this paper the problem of the transfer of radiation in an atmosphere of free electrons in thermal motion is considered. Proper allowance is made for the noncoherency of the scattered radiation, but the Compton shifts in frequency of the scattered quanta are ignored. By using a Fourier integral transformation over the frequency, the equation of transfer and the relevant boundary conditions are reduced to subsidiary forms. It is shown, further, that the transformed equation of transfer can be solved, in the space of the auxiliary variable, by the standard methods of transfer theory. The explicit solution found in a first approximation is inverted, and the dependence on frequency of the emergent radiation is studied.

The final solution to the problem is written down as the sum of two terms: one representing the fraction of the incident radiation which emerges without having suffered any scattering process and the other representing the diffuse radiation which has arisen after one or more scattering processes. This diffuse radiation for incident monochromatic light has been evaluated numerically, and its values tabulated for four optical thicknesses of the electron atmosphere. The numerical examples studied for hypothetical absorption lines reveal that the main effect of the noncoherency of the electron scattering is to fill the center of the lines with radiation from the neighboring continuum and to produce very extended and shallow wings. Finally, some general remarks are made concerning the relationship between the properties of the solutions found and certain characteristics of the line spectrum of high-temperature stars.

ATOMIC BOMBS

1236 Atomic Warfare, Facts and Speculations (Atomkrig, Fakta och Spekulationer), by Nils Ahlgren. Stockholm, Norstedt, 1946. 149 p. (In Swedish)

This is a discussion for the general reader dealing with the recent progress in the development of explosives and guided missiles; constantly expanding knowledge of atomic energy and progress

made toward its control; the possibilities of future atomic warfare; the influence of atomic weapons upon military strategy and tactics; means of defense against atomic warfare; and Sweden's defense problems.

BIOLOGICAL EFFECTS OF RADIATION

1237 The Histological Effects of X-Rays on Chickens with Special Reference to the Peripheral Blood and Hemopoietic Organs, by Raymond Murray, Mila Pierce, and Leon O. Jacobson. AECD-2303 (CH-3873), March 2, 1948, decl. September 17, 1948. 69p. For inclusion in NNES.

Chickens, 3 to 11 weeks old, were treated with doses of 200 kv x-rays, ranging from 2 r to 1200 r. The median lethal-dose for 3-week-old chickens appeared to lie between 400 r and 800 r. Histopathologic changes in the 11-week chickens paralleled those reported for mammals of comparable maturity, with the exception of damage to neurilemma sheath cells in the chickens. The 3-week-old chickens suffered additional damage to immature structures, but the threshold of observable damage to the lymphatic tissue (25 r) was comparable to that reported for mammals.

By application of a slight modification of Kyes' method for peripheral blood counting of fowl, dramatic decrease in blood constituents, paralleling those reported elsewhere for mammals, were seen in 3-week-old and 5-week-old chickens after treatment with 600 r and 800 r, respectively. Numerous degenerating cells were observed in dry smears made during the first week after irradiation, in contrast to the scarcity of such findings in smears of mammalian blood at the same period. Although the normal values for leukocytes of chicken blood were found to be several times those of mammalian blood, this difference could account only in part for the greater degeneration observed in the chickens.

1238 Effects of X-Rays on Tissue Metabolism, by E. S. Guzman Barron. AECD-2316 (CH-3654), October 29, 1946, decl. September 17, 1948. 22p. For inclusion in NNES.

The effect of x-rays, given in a single dose of total body radiation at doses varying from 900 r to 100 r, on the metabolism of tissues has been studied. Litter-mate rats of the Sprague-Dawley strain were treated with x-rays and sacrificed at different intervals. The metabolism of the following tissues was studied: spleen, liver, kidney, thymus, adrenals, testis, and submaxillary glands. Whenever possible measurements were made of the O_2 uptake in the presence of oxidizable substrates requiring sulfhydryl enzymes for oxidation, as these enzymes, were previously found more susceptible to the action of x-rays.

In general, the respiration of all tissues and the oxidation of substrates requiring sulfhydryl enzymes was diminished immediately after irradiation, with thymus as the only exception. Oxidation of pyruvate, of succinate, of d-amino acids and of 1 (+) glutamate - all requiring sulfhydryl enzymes - was inhibited in the different tissues examined. 11 tables, 18 references.

1239 Acute Histopathological Effects of Single Doses of Slow Neutrons on Mice, by R. Snider. AECD-2326 (CH-3766), February 5, 1947, decl. September 15, 1948. For inclusion in NNES.

Histological observations were made on the following structures of CF_1 female mice (after exposure to 400 arbitrary units of slow neutrons): spleen, liver, pancreas, thymus, bone, cartilage, mesenteric lymph node, heart, lung, kidney, bone marrow, adrenal, ovary, fallopian tube, stomach, duodenum, ileum, colon, peripheral nerve, autonomic ganglia, and skeletal muscle. The spleen, lymph node, bone marrow and thymus were the organs most severely damaged by the treatment. All of these organs had returned to the appearance of those in the control animals by 30 days post-treatment time. No damage was noted in the bone, cartilage, skeletal muscle, peripheral nerve, autonomic

ganglia, liver, kidney, pancreas, heart, lung, adrenal, stomach, fallopian tube, or colon. There was minor damage in the ovary and duodenum. It is pointed out that the tissue response following slow neutron irradiation is similar to that following X-ray treatment, as reported in the literature.

1240 Additivity of Fast Neutrons and Gamma Rays in Their Acute Lethal Action on Mice, by R. E. Zirkle, J. R. Raper, E. F. Riley, and G. E. Stapleton. AECD-2328 (CH-2571), June 5, 1945, decl. September 17, 1948. 19p. For publication in NNES.

By exposing various groups of mice to graded doses, the median lethal dose (LD50) of each of the following radiations was determined: (a) fast neutrons from the Clinton pile; (b) Radiation G, consisting of gamma rays contaminated with fast neutrons; (c) Radiation M, a mixture of fast neutrons and Radiation G. The LD50 of Radiation M was found to consist of 0.52 times the LD50 of fast neutrons plus 0.55 times the LD50 of Radiation G. Theoretically, the sum of these two fractions should be unity if fast neutrons and Radiation G are radiobiologically additive. Since the experimental deviation from unity (7 per cent) is within the error of the measurements, it is concluded that complete additivity of these two radiations has been demonstrated. It is assumed that this conclusion concerning additivity of fast neutrons and Radiation G may be extended to additivity of fast neutrons and pure gamma rays. The LD50 of fast neutrons, directly determined, was 91 n. The LD50 of pure gamma rays, indirectly determined from the experimental data, was 812 r. In another experiment, performed later for a different purpose, a corresponding value of 840 r was obtained.

1241 Effects of Radiation on Hemopoiesis, by John S. Lawrence, Andrew H. Dowdy, and William N. Valentine. Radiology 51, p. 400-413, September 1948. (See also MDDC-853).

The types of radiant energy under discussion are either electromagnetic energy waves, such as roentgen and gamma rays, or particulate matter having mass, such as alpha and beta particles, protons, and neutrons. The effects following radiation administered as: 1) single dose to the body as a whole, 2) repeated small doses to the body as a whole, 3) single or repeated doses to one area, and 4) internal radiation (probably beta and gamma mostly) were considered.

The greater part of the observations referring to the irradiation with a single dose to the body as a whole have been performed on animals. The hemopoietic picture is decidedly affected in any post-irradiation period for the duration of the life and by the speed of utilization of the different morphological elements in the blood. For example, after a dose of 500 r, the rapid decrease in lymphocytes reflects their short life span, for the first decrease was observed in fifteen minutes. The granulocytes did not decrease appreciably in numbers until the end of 24 to 36 hours. The platelets began to disappear at the end of 72 to 120 hours, and the erythrocytes between 120 and 168 hours. After doses of 200 r or less very few or no changes in the erythrocytes or platelets were observed. When the dose was less than 100 r, no large reductions in the reticulocytes were noted. However, a dose of 25 r caused a decrease in the formation of lymphocytes at the end of 24 hours. The results were less well defined in studies of the effect of small repeated doses; but in all the animals studied, distinguishable changes in some of the hemopoietic elements were observed after a year of daily exposure to 10 r.

In spite of the fact that changes could not always be demonstrated following small repeated doses, no doses were so small that they did not affect the average survival of large groups of animals. From this it is apparent that the total dose is important and that the small daily exposures to x-rays are cumulative. The incidence of leukemia clearly increased in the animals exposed repeatedly to small doses. Experiments demonstrated clearly that local irradiation does not produce direct effects upon the hemopoietic tissues that are not directly in the exposed region.

Since the larger part of human exposure probably take the form of small repeated doses, the most important deductions from these studies are concerned with the cumulative effect and the total

dose in the production of pathological changes. There is the possibility of leukemia and related illnesses to be considered whenever there is exposure to a considerable quantity of x-rays. And finally an apparent recovery from radiation effects may be followed by the sudden appearance of severe anemia or other blood dyscrasies.

1242 The Effects of Radiation on Vaccinia Virus, and on Bacteriophages, by M. H. Salaman. British Journal of Radiology, Supplement No. 1, p. 29-34, 1947.

The effect that was observed in vaccinia was the loss of infectivity for the rabbit, and in the phages the loss of power to lyse the sensitive bacterium. The vaccinia used was one derived from Lister Institute sheep lymph. The phages used were Staphylococcal phage K, Bact. coli phage C36, and Bact. dysenteriae phage S13; their diameters were 64 mu, 42 mu, and 16 mu, respectively. A measured drop of each specimen was placed on a gelatin film on a cover slip and dried at 37°C. Gamma rays of radium, x-rays of wavelength 1.5 A, and α-rays were used. After irradiation the material was dissolved from the cover slips. Then all specimens irradiated with one type of rays and an untreated control were titrated on the same rabbit. The vaccinia virus was most readily inactivated by γ-rays, x-rays, and α-rays, respectively. The amount of irradiation needed to inactivate the bacteriophages increased with diminishing particle size. Since it has been shown that a single ionization in the genetic apparatus of a cell may cause a permanent and detectable effect, the author suggests that the same argument applies to vaccinia. Then the loss of vaccinia infectivity may be assumed to be an expression of a mutation in that material caused by ionization within its genetic material. 2 figures. 4 tables. 7 references.

1243 Influence of Age on Susceptibility of Mice to the Development of Lymphoid Tumors after Irradiation, by Henry S. Kaplan. Journal of the National Cancer Institute 9, p. 55-56, August 1948.

Black mice, strain C57, were divided into age groups of 2 weeks, 1, 2, 3, and 4 months, and given fractional dosages totaling 1,000 r of x-radiation administered in 12 consecutive daily doses at 125 kv, 5 milliamperes, 30 cm mouse-to-target distance, 3 mm A 1 added filtration, output 42 r per minute, and a daily dose of 84 r. However, the dosage for the 2-week group had to be reduced to 750 r because of the high death rate following irradiation at 1,000 r. The animals were autopsied and examined histologically. The tumors were all lymphatic leukemias and lymphosarcomas. The maximal susceptibility was found to be at one month or earlier and it is associated with a shorter mean induction time. 1 table, 2 figures, 5 references.

1244 Inhibition of Plant Growth by Irradiation. Part I. Discrete Steps of Growth Inhibition and Pattern of Dose-Response-Relation, by Henry Quastler and Marianne Baer. Journal of Cellular and Comparative Physiology 31, p. 213-234, April 1948.

Seeds of Mung beans were treated with various doses of roentgen rays and subsequently allowed to grow in test tubes. The growth of primary root, hypocotyl, and epicotyl were observed and recorded. Each of these three parts grows only for a limited period of time reaching a limited length, even in normal plants. The final length is a useful measure of growth.

Irradiation inhibits growth. The relation between final length of primary root and dosage administered shows a pattern characterized by several levels, where the root length remains stable in spite of considerable changes of dosage, and intermediate zones where the root length is labile and varies with dosage. The latter correspond to relatively narrow dosage zones. The dose-response relations for hypocotyl and epicotyl are similar to but simpler than those for the root. It is assumed that the complex pattern of relations between dosage administered and growth inhibition observed corresponds to an equally or more complex hierarchy of growth mechanisms.

BIOLOGICAL EFFECTS OF RADIATION

1245 Modification of X-ray Effects on Barley Seeds by Pre- and Post-treatment with Heat, by Luther Smith and R. S. Caldecott. Journal of Heredity 39, p. 173-176, June 1948.

This is a report of a preliminary investigation to determine to what extent exposure to heat, either before or after x-raying, alters the biological effects of irradiation. Dormant seeds of Himalaya barley were subjected to unfiltered radiation of approximately 1,000 r per minute at 15 milliamperes and 26 Kvp before or after heat treatment set at a temperature and duration just below the lethal point. In one test 3,000 seeds were given 15,000 r units, 870 seeds were heated for 30 minutes at 75°C.; 3,000 seeds were given 15,000 r units and then immediately heated for 30 minutes at 75°C. and 3,000 seeds were heated for 30 minutes at 75° C and immediately exposed to 15,000 r units. In a second test only 100 seeds were given each of the treatments and the X-ray dosage was increased to 20,000 r and the heat treatment decreased to 65° C. for 30 minutes.

Seeds from each lot were germinated in petri dishes. The remaining seeds from the first test were planted directly in the field and the remaining seeds in the second test were planted in flats. Root tips were examined using the acetocarmine smear method for chromosomal bridges during late anaphase and early telophase. The results indicate that the frequency of chromosomal bridges, considered a reliable measure of the frequency of induced chromosomal aberrations, in the root tips was reduced by half when the seeds were subjected to the heat treatment immediately before or immediately after x-raying. Heat treatment after irradiation seemed also to increase mutation rate in the x-ray seeds as compared with the rates in seeds treated with x-rays alone or with heat before irradiation. The correlation between the frequency of chromosomal bridges, mutation rate, or injury resulting from different treatments or combinations of treatments was by no means perfect. 3 tables. 14 references.

1246 On the Frequency and Transmitted Chromosome Alterations and Gene Mutations Induced by Atomic Bomb Radiations in Maize, by E. G. Anderson. Proceedings of the National Academy of Sciences 34, p. 387-390, August 1948.

Samples of maize seed of the single cross L289 x I205 were exposed to the atom bomb radiations at Bikini. Other samples were exposed to 15,000 r units X ray. They were then tested for hereditary chromosomal alterations and gene mutations. The seeds exposed at Bikini were found to have received nearly 15,000 r units X ray. In maize, chromosomal alterations can be readily detected by partial pollen sterility. In this study the frequency of alteration was found to be 4.7-6.4 per cent in progenies not entirely random. Random frequency was estimated to be between 4.5 and 5.0 per cent. Gene mutation frequency was very high with probably more than 50 per cent of the gametes of the exposed generation carrying one or more gene mutations. The frequencies of chromosomal alterations and of gene mutations in the Bikini group were roughly equal to those in the X-rayed group.

1247 Some Effects of Radiant Energies on the Eye, by Cortez F. Enloe. Sight-Saving Review 18, p. 77-83, Summer 1948.

The author reviews the various types of radiant energy, and reports in some detail present-day knowledge concerning the energy of the atomic nucleus and its relation to the eye. He notes that thus far the effects of radiation have not presented a great problem in the field of occupational ophthalmology and that the small amounts of radioactive material which might be found in factories in peacetime produce little direct effect upon the eye. It is stated that to date no primary damage to the ocular structures has been observed that could be interpreted as a direct result of atomic radiation. The lesions occurring from exposure to the flash during bomb detonation were found to be identical with those resulting from overexposure to infrared. The retinal changes and the four types of hemorrhage (flame, petechial, "Roth"-type and vitreous) observed in people subjected to atomic bombing are felt to be directly related to the deficiency in the blood elements and in no way directly

BIOLOGICAL EFFECTS OF RADIATION

related to the action of radiation on the eye. These lesions disappear after the blood returns to normal, and thus far there has been no report of permanent residual damage from the retinal lesions.

BIOLOGY, GENERAL

1248 Oral Conditions upon Chronic Exposure to UF_6, by Peter P. Dale. AECD-2329 (II-188-7538), August 1945, decl. October 5, 1948. 9p. For use as a thesis.

Thorough physical, medical, and dental examinations of ten volunteers chronically exposed to UF_6 for about six months disclosed normal findings. No untoward results were observed in six subjects requiring minor oral surgery. Fluorimetric analyses were obtained from three extracted vital teeth and a sample of alveolar bone from two of the men. The crowns, the gingival two-thirds of the roots and the apical third (root tips) were analyzed. The data indicated substantial uranium storage in the dental root tips and alveolar bone which was deposited by the systemic or hematogenous route. The low values in the crown suggest little or no uranium retention by direct contact.

1249 Observations of Burn Scars Sustained by Atomic Bomb Survivors, by Melvin A. Block and Masao Tsuzuki. American Journal of Surgery 75, p. 417-433, March 1948.

A relatively high incidence of scar keloid and hypertrophic scar formation of a severe degree has occurred after healing of flash burns that probably were of deep second or third degree severity and in a people (Japanese), some of whom perhaps have a predisposition for the development of scar keloids. At this late date, the lack of complete, detailed, continuous studies and records on a large group of cases dating from the time of the occurrences of the injury and the large number of variables to be considered render impossible a complete evaluation and understanding of scar keloid formation. The inadequate treatment, poor nutrition, high incidence of severe infection and delayed healing should be considered as important contributing factors which affected the healing process to result in a high incidence of severe keloid or excessive scar formation. Scar keloids were found to occur in Japanese sustaining burns from other causes than the atomic bomb explosion. It would seem most probable that the scar keloids represent no peculiar effect of the atomic bomb explosion. Furthermore, it seems probable that a similar incidence of occurrence of scar keloids could have occurred in burns of the same severity from any other cause under similar conditions during the healing of the lesions in patients having the same general state of health.

CHEMISTRY, ANALYTICAL

1250 A Study of the Separation of a Trace of Silver from a Macro Amount of Palladium by Electrolysis, by J. C. Griess, Jr. and L. B. Rogers. AECD-2299 (ORNL-91), June 21, 1948, decl. September 15, 1948. 39p. For publication in Journal of the Electrochemical Society.

Several complexing agents were used in a study of the electroseparation of silver and palladium. Polarograms obtained with a solid electrode provided a practical basis for judging the feasibility of a separation. Cyanide was found to produce the most favorable separation while, at the same time, allowing a nearly complete recovery of silver. It has been shown that repeated electrolyses are feasible, and that one can thereby separate silver, produced by neutron bombardment of palladium, which has a high specific activity and which is chemically and radiochemically free from palladium.

1251 Determination of Microgram Quantities of Oxygen in Metals and Compounds by Vacuum Fusion, by R. L. Seifert, L. O. Gilpatrick, T. E. Phipps, and O. C. Simpson. AECD - 2331 (ANL-HDY-504), n.d., decl. September 29, 1948. 14p. For inclusion in NNES.

CHEMISTRY, ANALYTICAL

The vacuum-fusion method for the determination of oxygen has been adapted to the analysis of small samples. The method is based on the fact that all the oxygen present in a metal sample is liberated as carbon dioxide or carbon monoxide by fusion of the sample in graphite in a vacuum. The gases evolved by the vacuum-fusion are analyzed by volumetric measurement after successive removal of constituent gases by solid reagents. The analysis of pure oxides is not as accurate as the analysis of metal samples. 20 ppm of oxygen can be detected in a 10 mg sample of metal. 17 references.

1252 Determinations of the Halides in Heavy Metal Bromides and Chlorides by Potentiometric Titration, by M. J. Wolf. AECD-2332 (ANL-HDY-507), n.d., decl. September 29, 1948. 10p. For inclusion in NNES.

In determining the composition of certain experimental preparations of heavy metal chlorides and bromides, a method of analysis was devised capable of estimating as little as 10 micrograms of halide ion to within a few percent. The method consists of direct potentiometric titration of the halide solution with standard silver nitrate in a special, enclosed, glass apparatus. With a platinum-saturated potassium nitrate reference-electrode and a Ag, AgBr, Br indicator electrode, it is possible to determine bromides with an accuracy of about ± 1.5 percent at bromide ion concentrations as low as 0.00025 N. With the same reference electrode, chlorides are determined with about the same accuracy at minimum concentrations of approximately 0.001 N.

1253 Automatic Potentiometric Titration of Iron and Titanium with Chromous Ion, by James J. Lingane. Analytical Chemistry 20, p. 797-801, September 1948.

Automatic potentiometric titrations of Fe(III) and Ti(IV) with chromous ions in sulfuric and hydrochloric acids were performed, using a platinum and a mercury indicator electrode. For titanium (IV) the optimum condition was the use of the mercury indicator electrode with sulfuric acid. The titration was precise to about ± 0.2 per cent. By titrating with chromous ion in solutions of about 4N sulfuric acid, and using a platinum indicator electrode for iron and a mercury indicator electrode for the subsequent titration of the titanium, very satisfactory determinations of iron and titanium may be made. The experimental cell is described in detail, and the automatically recorded titration curves are shown.

1254 Determination of Lead in Air, by L. J. Snyder, W. R. Barnes, and J. V. Tokos. Analytical Chemistry 20, p. 772-776, August 1948.

A field micromethod was developed for the determination of lead in air (in form of tetraethyllead). The gas is scrubbed in iodine-potassium iodide solution and analyzed colorimetrically. The method is accurate to better than 1 microgram of lead per cubic foot of air.

1255 Semimicrodetermination of Fluorine in Volatile Organic Compounds, by Walter C. Schumb and Kenneth J. Radimer. Analytical Chemistry 20, p. 871-874, September 1948.

An apparatus for a simple and rapid semimicroanalysis of fluorine in volatile organic compounds is described. A saran tubing absorber is used after the sample has been passed through a platinum tube at 1100°C with moist oxygen. Whereas the number of equivalents of hydrogen (as water) need be only slightly greater than the number of equivalents of fluorine, the number of equivalents of oxygen must be about forty times the number of equivalents of oxidizable carbon and hydrogen. Passage of the decomposition products through water absorbs any hydrogen fluoride, while carbon dioxide and any chlorine present largely pass through the acidic solution. Phenolphthalein is added to this solution, which is then neutralized and added to a solution of titanium sulfate, hydrogen peroxide, and sulfuric acid. The bleaching effect of the fluoride on the brown color of the acidic peroxidized titanium solution is measured with a Klett-Summerson colorimeter and a calibration curve prepared with known amount of sodium fluoride. A typical calibration curve is given. 33 references.

CHEMISTRY, GENERAL

1256 Chambers Works Process for the Manufacture of Fluorine Cell Electrolyte ($KF \cdot 2(3HF)$) at East Area, by E. I. duPont de Nemours and Company. AECD-2320, May 27, 1944, decl. September 28, 1948. 4 p. Informal disposition. Document for sale by AEC.

In this process, fluorine cell electrolyte is prepared by mixing anhydrous hydrofluoric acid (HF) with potassium acid fluoride (KHF_2) in such proportions that the resulting solution contains 43-44.5% HF. This report lists equipment and specifications, and describes the preparation procedure.

1257 Chambers Works Process for the Recovery of Fluorine Cell Electrolyte $KF.2(3HF)$ at East Area, by E. I. DuPont de Nemours Company. AECD-2330, September 19, 1944, decl. September 28, 1948. 4 p. Informal disposition. Document for sale by AEC.

Spent electrolyte, containing 5% iron or less, from the manufacture of gaseous fluorine (F_2) is allowed to settle for 24-48 hours in order to separate metallic fluorides in the form of sludge. The clear electrolyte is decanted off the sludge and returned to the system for reuse; and the sludge is blown to a water filled pit. The sludge clinging to the walls of the electrolytic cell is dissolved in hot 15% NaOH solution. The equipment used and the procedure followed is described in detail.

1258 Fluorine Disposal Continuous Process, by Ralph Landau and Raphael Rosen. Industrial and Engineering Chemistry 40, p. 1389-1393, August 1948.

A continuously operated absorber of industrial size is described. The absorber, which is sodium hydroxide solution of concentrations higher than 2 per cent, is continuously regenerated with lime. Carbon brick lining was found satisfactory for the portions of the equipment coming in direct contact with fluorine. Tests showed that fluorine and hydrogen fluoride were almost completely removed. Gases showed 3 ppm. fluorine (or hydrogen fluoride), which is believed to be non-toxic. Operational data are given, and the results obtained during the month of testing were supported by the smooth operation of the disposal process over a period of time.

COSMIC RADIATION

1259 Tracks in Emulsions at 100,000 Feet, by E. O. Salant, J. Hornbostel, and E. M. Dollmann. Physical Review 74, p. 694, September 15, 1948.

Nuclear emulsions were exposed to cosmic radiations at 100,000 feet in a balloon. An examination shows 211 stars of many (= 5 or more) prongs, 4 stars produced by mesons, one star emitting a meson, and one π-μ-decay. A table of prong distribution among stars is given. This shows that as prongs increase, stars appear less frequently. An upper limit can be set for the rate of production, which is 2000 per cc of emulsion per day for stars of 4 or more prongs. No evidence for a "close neighbor" effect (L. Leprince-Ringuet and J. Heidmann; D. H. Perkins, Nature 161, p. 844, 1948) was found.

CRYSTALLOGRAPHY

1260 A Method for the Preparation of Large Crystals of Anhydrous Manganous Sulfate $MnSO_4$, by William W. Wellborn. AECD-2305 (LADC-561), August 12, 1948, decl. September 20, 1948. 3 p. Informal disposition. Document for sale by AEC.

Large crystals of anhydrous manganous sulfate were prepared by crystallization from a solution of concentrated sulfuric acid maintained at 200°C.

CRYSTALLOGRAPHY

1261 Electron Diffraction by Graphite (Diffraction des Electrons par le Graphite), by J. Hoerni and J. Weigle. Helvetica Physica Acta 21, p. 215-216, 1948. (In French)

Homogeneous crystals of graphite, 500 to 1000 A thick, were submitted to electron diffraction studies. Two strong waves were observed. For the Fourier coefficient ϕ 100, the value is 1.7 volts, for ϕ 110, the value is 3.2 volts. The Fourier coefficient is independent of the crystal thickness between 500 and 1500 A and of the voltage between 20 and 50 kv. In cases where more than two strong waves exist in the crystal, the situation becomes more complicated, but the diffractions permit the assignment of a morphology of the surfaces of dispersion. Studies are being carried out in this direction.

1262 Neutron Diffraction and Associated Studies. Part II, by E. O. Wollan and C. G. Shull. Nucleonics 3, No. 2, p. 17-31, August 1948. (Summary of various MDDC's)

Neutron diffraction, using the powder crystal method as well as Laue photographs, is reviewed. Theory, procedures, and typical neutron diffraction patterns for diamond, aluminum, NaH, and NaD are given. The possibility of determining the location of hydrogen atoms in hydrogeneous crystals is particularly emphasized. Scattering data from orthopara hydrogen scattering are given. This is the second of two papers on the subject. The first paper was abstracted in Nuclear Science Abstracts as Abstract No. 496.

1263 Theory of Strain Interaction of Solute Atoms, by C. Zener. Physical Review 74, p. 639-647, September 15, 1948.

A general method is developed for evaluating the strain-energy interaction of solute atoms in body-centered cubic lattices. The method has many features in common with that used in the evaluation of the interaction of electric or magnetic dipoles, a surface distribution of forces replacing a surface distribution of electric charge or of magnetic poles. Particular emphasis is given to the interaction of interstitial solute atoms in body-centered cubic lattices, where the possibility exists of a self-induced preferential distribution of solute atoms in one of the three types of tetragonal interstitial positions.

FLUOROCARBONS

1264 A Study of the Reactions Between Tungsten Dioxide and Difluorodichloromethane, by A. Dinsmoor and Herbert A. Young. AECD-2315 (BC-70, Revised), July 15, 1948, decl. September 24, 1948. 30 p. For use as a thesis; for possible publication in a technical journal.

For this study of the reactions between WO_2 and CF_2Cl_2 at 525°C and atmospheric pressure the reactor used was of pure nickel, designed so that partial fractionation of the subliming reaction products was obtained. Analysis of the voltile tungsten-containing products separated by the nickel fractionating system showed the presence of WCl_6, WF_6, $WOCl_4$ and WOF_4. In addition C, CO, CO_2, $COCl_2$, COF_2 and small amounts of unidentified perhalocarbons were found in varying amounts. Consideration of the results indicated that the main reaction may be represented by the equation, $2\ WO_2 + 2\ CF_2Cl_2 = WOF_4 + WOCl_4 + 2CO$. The production of CO_2 and of WF_6 and WCl_6, as well as $COCl_2$ and COF_2, can come about either through competing primary reactions or through secondary reactions. 16 references.

FLUOROCARBONS

1265 Rapid Determination of Hydrogen in [$C_{21}F_{44}$] Oils, by L. L. Burger and M. J. Rosen AECD-2317, April 10, 1945, decl. September 22, 1948. 10 p. Informal disposition.

A summary of data on hydrogen content, density, specific refraction and fluorescence of $C_{21}F_{44}$ oils is presented. Hydrogen values are those obtained by L. J. Rainwater from neutron scattering measurements. Density, specific refraction and fluorescence may indicate the amount of unreacted hydrogen in $C_{21}F_{44}$ oils if measurements are restricted to samples having a similar history. Production variables are least important in the case of specific refraction. The presence of HF complicates the interpretation of the data. Attempts to fit the experimental specific refraction curve were successful if the atomic refraction of fluorine was raised to about 1.33 or the composition of the pure fluorocarbon taken as $CF_{1.77}$ instead of CF_2.

1266 Determination of Hydrogen in Fluorocarbons, by L. L. Burger. AECD-2318 (A-3801), n.d., decl. September 21, 1948. 3 p. Informal disposition.

Determination of hydrogen in fluorocarbons by neutron scattering, fluorescence and specific refraction is discussed. For each of the three methods, principle, apparatus and procedure are summarized.

1267 Determination of Hydrogen [in Fluorocarbons], by L. L. Burger and L. Rainwater. AECD-2319 (A-1212), October 21, 1943, decl. September 22, 1948. 18 p. Informal disposition.

This method of determination of hydrogen in fluorocarbons is based on the fact that the slow-neutron cross section of hydrogen is several times that of either fluorine or carbon. A small amount of unreplaced hydrogen in the fluorocarbons will then produce a relatively large decrease in the neutron transmission of a sample placed in a collimated beam of slow neutrons. The transmission of the sample is compared with that of a standard by alternating measurements. Apparatus is discussed in detail in this report. Results are summarized in a table.

HEALTH PROTECTION

1268 Health Physics, by R. E. Lapp and H. L. Andrews. Nucleonics 3, No. 3, p. 60-67, September 1948.

This is a brief summary of the principal phases of radiation health protection, dealing principally with the biological effects of radioactivity. The discussion embraces a consideration of permissible levels of radiation exposure and the role of the health physicist. Other topics covered radiation hazards, absorption of radiation by tissue, radiation units and dosages, and waste disposal. 29 references.

1269 Veterinary Aspects of Atomic Explosion, by Wayne O. Kester and Everett B. Miller. Journal of the American Veterinary Medical Association 63, p. 325-329, October 1948.

This paper presents in simple terms the conditions that a veterinarian might find in an area where an atomic bomb had recently exploded. Some of the unsolved problems confronting the veterinary profession are mentioned. Probably the biggest problem in the veterinary public health field would be in instances where large stores of food or large numbers of animals have been subjected to direct or massive delayed radiation. Because a means of differentiating animals lethally exposed to radiation from those sublethally exposed has not been developed, it is a problem when large numbers of animals have been exposed and only a limited number can be treated. The facts known about atomic explosion with respect to veterinary medicine are presented as being meager.

INSTRUMENTS

1270 Suggestions Toward Improving the Accuracy of the Passive Simulator, by Victor B. Corey. AECD-2297, n.d., decl. September 20, 1948. 5 p. For publication in a technical journal.

Some of the present characteristics of the passive one-dimensional simulator are discussed briefly, and a few simple experiments are outlined which might be carried out to determine whether the accuracy of passive simulator solutions of complex problems can be significantly improved by using different operating procedures. The conditions are stated under which the passive simulator will give a precise solution for the particular one-dimensional case where the simultaneous equations are known to be represented by cosine curves.

1271 Space Simulator, by V. B. Corey. AECD-2298, June 20, 1947, decl. September 20, 1948. 50 p. For publication in a technical journal.

An investigation has been made of the properties of various types of electrical networks which may be used to provide solutions of simultaneous partial differential equations of the type

$$\Delta^2 \phi - a\phi + b\theta = 0, \text{ and } \Delta^2 \theta - c\theta + d\phi = 0.$$

Networks most commonly used for obtaining solutions of this type may be divided into two principal categories: Active networks which contain active elements in the form of amplifiers, and passive networks which contain only such passive elements as resistors, inductors and capacitors. The basic theory underlying the operation of such networks depends upon developing a formal analogy between the equations describing an iterative electrical network and the finite difference form of the partial differential equations to be solved. This basic theory is developed both for passive electrical networks and for active electrical networks. The theoretical discussion includes: (a) Derivation of the fundamental relationships between circuit constants and the coefficients a, b, c, and d which appear in the differential equations; (b) Conditions governing the choice of proper mesh interval; (c) Extension of the general theory to three dimensions; (d) The extension of the general theory to include the solution of "n" simultaneous equations; (e) Transitions which involve a change in mesh interval (e.g. from coarse to fine network).

The comparative advantages of the experimental use of active and passive networks are discussed. A study is made of the relative ease with which the equation constants may be changed in active and passive simulators. Evaluation is made of the relative number of components which will be required by each of these two different types of simulator, and general conclusions are drawn as to their overall relative merits.

A one-dimensional model simulator has been constructed. A description of the design of the simulator, together with some typical data which it has provided, is included. These data are analyzed in detail, and comparisons are made between the experimental values obtained from the simulator and the true analytical solutions of the partial differential equations which may be obtained in certain specific instances. It is shown that the simulator produces results which are accurate to approximately plus or minus 2% and a detailed discussion of these errors and their probable causes is given.

1272 The Use of Standard Broadcast Receivers as Radioactive Indicators, by Wm. D. Schafer. AECD-2310 (LADC-554), n.d., decl. September 21, 1948. 4 p. For publication in Electronics.

By connection of a Geiger-Mueller tube to a standard home or automobile radio and instrument can be provided which will indicate the presence of radioactivity and roughly indicate the amount. Diagrams of the connection are included.

INSTRUMENTS

1273 The Discharge Spread in Geiger-Mueller Counters, by S. H. Liebson. Physical Review 74, p. 694-695, September 15, 1948.

The author points out that in the review article by Corson and Wilson (Review of Scientific Instruments 19, p. 207, 1948) in which these writers compare results of a paper by Alder, Baldinger, Huber, and Metzger (Helvetica Physica Acta 20, p. 73, 1947) with results obtained by Liebson (Physical Review 72, p. 602, 1947) on the discharge mechanism of self-quenching Geiger-Mueller counters filled with organic vapors and inert gas, no consideration was taken of the fact that Liebson's distances do not represent the absolute distance between the effective counters. Actually the effective absolute distances would be decreased by about 1 cm. It is also pointed out that the measurements of Alder et al are not suitable for comparison with results using organic vapors and inert gas such as reported by Liebson.

1274 Orgin of the Temperature Effect on the Alcohol-Argon Geiger-Müller Tube (Origine de l'Effet de Température sur le Tube de Geiger-Müller à Alcool-Argon), by G. Joyet and M. Simon. Helvetica Physica Acta 21, p. 180-183, 1948. (In French)

By preparing several Geiger-Müller tubes from different materials the authors investigated the cause of the temperature effect on operating characteristics. Temperatures ranged between 4.9°C and 45°C. It is concluded from the experimental results, together with theoretical considerations, that the temperature effect is not due to alcohol vapor dissociation, but is due to the absorption of the alcohol vapor by certain materials in the walls of the tube. The most active materials are, in the order of their importance, cibanite and picene, and anticorodal. Pyrex, electrolytic copper, Apiezon W wax, and polystyrene do not provoke a temperature effect.

1275 Radiation Measuring Instruments: Their Selection and Use, by Duncan A. Holaday. Industrial Hygiene Newsletter 8, No. 8, p. 10-13, August 1948.

Integrating ionization chamber instruments must be used to measure intermittent radiation sources, and may be used to measure continuous fields. Rate meter instruments are useful to measure continuous sources but should not be used to survey intermittent ones. Ionization chamber rate meters are preferable for general use in surveying continuous sources to those based on the Geiger tube. The G-M meter is the best available instrument at present for detecting low levels of radiation, such as laboratory contamination, leaks in shielding, and other small sources. The Geiger instruments give good results in surveying sources of x- and gamma radiation, but they give only approximate readings in checking beta ray exposures. Photographic films do not have the accuracy which may be obtained from electrical instruments, but they are valuable adjancts and give a permanent record of exposure.

If radiation measuring instruments are working at all, the meter needles always indicate a reading when put in a radiation field. But to give validity to the readings it is wise to use two recently calibrated instruments and to take along a luminous button as a source of radiation to check their operation when making a survey.

1276 Radiation Survey Meter, by T. Enns. Journal of the Franklin Institute 246, p. 181-182, August 1948.

A simple portable instrument with a wide range of sensitivity has been constructed. The apparatus consists of an aluminum ionization chamber, and an electrometer circuit using the Victoreen VX 41 electrometer tube. The electrometer circuit is shown. Approximate sensitivities of the instrument to gamma radiation are: with 10^{10} grid resistor—one microampere = 0.720 r per hour; with 5×10^{11} grid resistor—one microampere = 0.0144 r per hour; with rate of grid setting—one microampere per second = 0.108 r hour. Maximum range of the instrument is 14.4 r per hour. Minimum practical range is one microampere per minute or 0.0018 r per hour.

ISOTOPES

1277 Some New Radioactive Isotopes, by Geoffrey Wilkinson and Harry G. Hicks. AECD-2306 (UCRL-162), August 6, 1948, decl. September 21, 1948. 3 p. For publication in Physical Review.

Present data on the following isotopes is summarized in tabular form: Tb^{152}; Tb^{153}; Tb^{154}; Tb^{155}; Ho^{160}; Ho^{161}; Ho^{162}; Ho^{164}; Tm^{166}; Tm^{167}; Tm^{168}; Lu^{170}; Lu^{171}; Lu^{172}; Ta^{176}; Ta^{177}; Ta^{179}; Re^{182}; Re^{183}; Re^{184}. For each isotope the table gives half-life, type of radiation, energy of particles, energy of γ-radiation, and producing reaction.

1278 The Fission Products and Their Uses, by L. Yaffe. Nucleonics 3, No. 3, p. 68-73, September 1948.

A brief historical review of the developments leading to the present day knowledge of fission and fission products is given, as well as an outline of the applications of bulk and separate fission products. In medicine they are used for therapeutic and diagnostic purposes and as tracers in biological experiments. In industry fission products may be put to a great many uses. For example, they may be employed in industrial control procedures and in alarm systems; in radiography they may replace Ra or low voltage X-ray sets. The bulk sources could be used to help follow the movements of oil beds, air masses, etc. The manufacture of luminous paints could employ beta emitters, which also may be employed in spark plugs and gas discharge lamps to reduce the striking voltage.

Individual fission products may be the sources for some nuclides which are not easily produced by other neutron reactions. When combined with Be, such products may be used as sources for photoneutrons. The individual members of the fission chains can also be used for the separation of pure stable isotopes. 18 references.

ISOTOPES SEPARATION

1279 Condensation of Radioactive Cadmium and Silver on Metal Surfaces (Kondensation von radioaktivem Cadmium und Silber an Metalloberflachen), by H. Frauenfelder, O. Huber, P. Preiswerk, and R. Steffen. Helvetica Physica Acta 21, p. 197-198, 1948. (In German)

Atomic disintegration products may be separated by selective adsorption in vacuo on metal surfaces. The half-lives of the products may then be determined. It was found that the condensation coefficients depend greatly on the state of the surface as well as the thickness of the adsorbed layer.

1280 Countercurrent Gaseous Exchange Method for the Separation of Isotopes, by R. B. Bernstein and T. I. Taylor. Journal of Chemical Physics 16, p. 903-916, September 1948.

A method is described for isotope enrichment by countercurrent gaseous exchange in a thermal diffusion column. The theory is derived for two cases of interest: diffusion limited and reaction-rate limited. Solutions of the equations are presented for the over-all separation S at the steady state as a function of the following: single stage enrichment factor α; diffusion constant D, or exchange rate constant k; length of column Z; and the convective flow L, which in turn depends on pressure, temperature, column dimensions, etc. The results may be expressed in the usual form $S = \alpha^N$. For the diffusion-limited case $N = 4\pi D_{\bar{c}} Z/L$, where $\bar{c}$ = moles of gas per cc. For the reaction-rate limited case the number of theoretical plates per unit length is given by the expression $N/Z = k/v$, where v is the convective velocity. Experiments are described in which C^{13} was concentrated by the exchange reaction $C^{12}O_2 + C^{13}O \rightleftarrows C^{13}O_2 + C^{12}O$. The observed dependence of the over-all separation upon the operational variables is consistent with the theory.

ISOTOPES SEPARATION

1281 The Self-Diffusion Coefficient of Nitrogen, by E. B. Winn. Physical Review 74, p. 698-699, September 15, 1948.

The self-diffusion coefficient of nitrogen was determined by placing $N^{14}N^{14}$ in one copper bulb and $N^{14}N^{15}$ in another copper bulb, the two bulbs being connected by a copper tube and the gases being at the same temperature and pressure. A continuous analysis of the two bulbs was made, using a 60° Nier-type mass spectrometer. The mean result of five diffusions is $(\rho D)_{20}°C = 258 \pm 10$ micropoises, where ρ is the density, and D the coefficient of self-diffusion. Reported values of ϵ are listed, where ϵ is a constant related to intermoleuclar forces in the equation $\rho D = \epsilon \eta$, η being the coefficient of viscosity.

MASS SPECTRA

1282 Mass Spectrographic Mass Assignment of Radioactive Isotopes, by Richard J. Hayden. Physical Review 74, p. 650-655, September 15, 1948. (See also MDDC-1546).

Characteristics of positive ion emission for various compounds on a tungsten filament are noted. Methods of analysis of mixtures of radioactive isotopes by mass spectrograph are described. The following mass assignments are made: 108-day yttrium, 88; 57-day yttrium, 91; 1-year ruthenium, 106; 300-day cerium, 144; 3.7-year element 61, 147; 55-day strontium, 89; 25-year strontium, 90; 60-hour yttrium, 90;12.6-day barium, 140; 40-hour lanthanum, 140.

1283 Mass Spectrometry and Nuclear Chemistry, by H. G. Thode. Nucleonics 3, No. 3, p. 14-24, September 1948.

The part the mass spectrometer played in the atomic energy development program and particularly the use of the instrument in gaseous fission product work is reviewed. Several mass spectrograms are given, and the application of the instrument in the field of nuclear chemistry is discussed with respect to half-life measurements, fission yields, and isotope ratios. 18 references.

METALLURGY

1284 Application of the High Temperature Calorimeter to the Determination of the Heats of Formation of Na-Sn and Li-Sn Alloys, by George R. Barber, Leo Brewer, LeRoy A. Bromley, and Raleigh L. McKisson. AECD-2294 (UCRL-103), July 1948, decl. September 21, 1948. 69 p. Informal disposition. Document for sale by AEC.

A method has been devised for using the high-frequency induction coil as a high temperature calorimeter. The method enables one to determine the heat effects produced at high temperatures. The method has been applied to the determination of the heats of formation of the alloys Na-Sn and Li-Sn. The average heat of formation (ΔH) determined for Na-Sn is -9.63 ± 0.40 kilocalories per mole at 873°K. This value becomes -10.6 ± 0.6 kilocalories per mole when extrapolated to 298°K. The average heat of formation (ΔH) determined for Li-Sn is -17.57 ± 0.83 kilocalories per mole at 850°K. This value becomes -18.62 ± 1.50 kilocalories per mole wnen extrapolated to 298°K. These results are compared with the results of other investigators. 24 references.

1285 Grinding of Beryllium Bronze, by Robert Gadeau and Rene Schweyckart. Microtecnic 2, p. 104-108, June 1948. (In English)

The quality of the grinding work depends on the worked metal, the quality of the wheel, the cooling liquid, the cutting characteristics (Profiling of the wheel, rotating speed of the piece, longitudinal feed). With adapted wheels, the grinding of beryllium bronze is easily done. The best results were obtained with hardened metal with a corundum wheel (size of grain 80 K, structure 5, vitrified bond) diamond profiled at 120 mm/mn. Soluble oil is the most favoured cooling liquid.

METALLURGY

It should be absolutely clean and carefully filtered. It seems that because of light scratches noticed on the pieces, the abrasive particles floating in the liquid are drawn between the wheel and the piece. Gasoline is not suitable as it does insure sufficient cooling of the piece. Grinding with soluble oil as a cooling liquid does not cause etching of the ground pieces. Nevertheless it is wise, after the pieces are ground, to immerse them for several minutes in petrol; this avoids all further corrosion, expecially the marks left by fingers on dry ground pieces.

1286 Nuclear Energy and Metallurgy, by C. Hubert Plant. Metal Industry 73, p. 123-125, 146-148, August 13 and 20, 1948.

Part I of this article begins with a little historical information on the discovery of radioactivity and x-rays. Three radioactive elements, namely, uranium, thorium, and actinium, are briefly discussed. Three types of radiation, alpha particles, beta rays, and gamma radiation are also discussed. The quantum theory of matter and energy is briefly mentioned.

Part II discusses the nucleus with the following headings covered: the constitution of the nucleus, properties of an atom, weight/proton anomaly, radioactive nuclei, nuclear "droplet" theory, surface tension energy, metastable nuclei, and "short-range" forces.

MINERAL RESOURCES

1287 Bohemian Uranium. Chemical Trade Journal and Chemical Engineer 123, p. 239, August 27, 1948.

The principal centers of the "uranium zone" in Bohemia are at Joachimstal, Gtesgab, Seifen, Weipert, and Hormislavkov. Together with big deposits in Saxony they form the richest uranium field in Europe. Before the war only three mines were worked. The Russians have steadily increased the number in operation since 1945, and today nearly 30 mines are working in Bohemia alone.

1288 Radioactivity and Atomic Energy (La Radiactividad y la Energia Atomica), by Juan M. de Azcona Lopez. Revista de Geofisica 5, No. 18, p. 232-246, April-June 1946. (In Spanish)

This paper is concerned with occurrences of radioactive minerals in Spain.

1289 Uranium, the Key and Source of Nuclear Energy (L'Uranium, la Clef et la Source des Energies Nucléaires), by Maurice Déribéré. Paris, Editions Elzevir, 1946. (Matières premières 1) (In French)

Following articles on the position of uranium in the periodic system and the relations between radium and uranium, this general treatise lists and describes the various minerals of uranium and their deposits throughout the world and in France.

MINERALOGY

1290 Samarskite and Xenotime from Machado, Minas Gerais, Brazil (Smarskita e Xenotima de Machado, Minas Gerais, Brasil), by R. Frayha. Mineracao e Metallurgia 12, No. 72, p. 287, March-April 1948. (In Portuguese)

Analysis of a sample of samarskite from a pegmatite vein shows it to contain 9.6% UO_2.

1291 Uranium Ore; How To Go About Finding And Mining It, by Paul Leach, Jr. Engineering and Mining Journal 149, No. 9, p. 75-77, September 1948.

Instructions are given to prospectors for finding, mining, reporting, checking, and selling uranium ores.

NEUTRONS

1292 The Neutron Pile as a Tool in Quantitative Analysis; the Gallium and Palladium Contents of Iron Meteorites, by Harrison Brown and Edward Goldberg. AECD-2296 (ANL-HDY-546), n.d., decl. September 10, 1948. 22 p. For oral presentation before an American Chemical Society symposium on nuclear reactions held in Portland, Oregon, September 16, 1948.

An investigation of the possibilities of using the neutron pile as a tool in quantitative analysis resulted in a method which is quite generally applicable and particularly useful in analyzing unknowns for minor constituents. The method has been applied to the problem of analyzing for minute concentrations of gallium and palladium in iron meteorites. The procedure was found to give consistent results, with standard deviations never exceeding twelve per cent. The procedure is not complicated, and is free from interferences by other elements and from the danger of contamination during the course of the analysis.

In general it may be summed up as follows: Irradiate a portion of the substance to be analyzed in the pile, together with a standard containing a known weight of the element being determined. Dissolve the unknown and add to the solution a known weight of the element being determined. Chemically process the element added in order to free it from the activities associated with other elements present in the unknown. Determine the chemical yield of the procedure. Compare the activity of the element in the unknown with that of the standard. Check on the purity of each activity by measurements of half lives and absorption spectra.

1293 The Emission of Light Charged Particles in the Slow Neutron Fission of Uranium, by L. L. Green and D. L. Livesey. Philosophical Transactions of the Royal Society of London 241 A, p. 323-343, August 31, 1948.

This paper describes the extension of the photographic plate technique to the recording of fission fragment tracks and the application of this method to the study of rare modes of fission in the case of the slow neutron fission of uranium. The emission of short-range light particles in the fission of U^{235}, reported by Cassels, Dainty, Feather, and Green (Proceedings of the Royal Society 191 A, p. 428, 1947), is confirmed and the angular and range distributions of these particles are described. In addition, the emission of long-range light particles with ranges up to 45 cm of air is described. The abundance of this mode of fission is 1 in 340 ± 40 fission events. The angular and range distributions of these long-range particles are given.

1294 Examination of the n-p Reaction on Phosphorus (Untersuchung der n-p-Reaktion an Phosphor), by F. Metzger, F. Alder, and P. Huber. Helvetica Physica Acta 21, p. 278-288, 1948. (In German)

The reaction, $P^{31}(n,p)Si^{31}$, was studied in an ionization chamber, the compound P_2O_3 being bombarded with 3-Mev neutrons. The energy for transition into the ground state is $Q = -0.97 \pm 0.13$ Mev. An excited level of the final nucleus Si^{31} lies about 0.7 Mev above the ground level. The effective cross section of the (n,p) reaction rises in proportion to neutron energy, and for 3-Mev neutrons is $\sigma = (7.4 \pm 1.5) \times 10^{-26}$ cm^2. Graphs and tables of experimental results are given. 20 references.

1295 Measurements of Neutron Intensities by Means of a Boron Lined Ionization Chamber, by Hans von Ubisch. Arkiv för Matematik, Astronomi och Fysik 35 A, No. 11, p. 1-9, 1948.

This paper describes a boron-lined, paraffin-shielded ionization chamber with a conventional type d-c amplifier. The neutrons from a Ra-Be source contribute only 1.8% to the total current from the chamber; 98.2% are due to gamma rays. Comparison with a similar non-lined chamber reveals that the boron lining increases the response to the unfiltered radiation from the cyclotron by a factor of 50.

NUCLEAR PHYSICS

1296 Atomic Energy, Glossary of Technical Terms. Lake Success, N.Y., United Nations, March, 1948. (U.N. Publications, 1948. IX. 1)

The equivalents of a number of technical and general terms in use in the field of atomic energy are given. The main glossary is arranged in 5 parts so as to give the terms equivalent to the words in each of the 5 official languages of the U.N.: English, French, Russian, Chinese, and Spanish. An appendix gives the names of the chemical elements in the 5 languages.

NUCLEAR PHYSICS - METHODS OF MEASURING

1297 Coincidence Measurements of Light- and Gamma-quanta, with Multipliers (Koinzidenz-Messungen an Light- und -Quanten mit Multipliern), by K. P. Meyer, P. Huber, and E. Baldinger. Helvetica Physica Acta 21, p. 188-192, 1948. (In German)

A multiplier was constructed with good resolution and sensitive to very small impulse amplitudes. A circuit diagram is given, as well as a graph of impulse frequency versus impulse amplitude. It is seen that the multiplication, in the case of exchange with visible light, starts with one electron so that the amplitude distribution gives only the statistics of the secondary electron multiplication. In the case of gamma quanta, impulses resulting from both 2 and 3 electrons are noticed. A resolution of 10^{-8} sec was obtained.

1298 Measurement of Radioactive Isotopes, Nucleonics 3, No. 3, p. 55-59, September 1948.

Standard samples of radioisotopes whose radioactivity has been accurately determined have been issued by the National Bureau of Standards so that uniform quantitative results can be obtained in all laboratories. The preparation, distribution, and use of these samples are outlined. A discussion of units for the expression of disintegration rate is included.

1299 Methods of Measuring Very Long and Very Short Half-lives, by S. Rowlands. Nucleonics 3, No. 3, p. 2-13, September 1948.

The well known methods of measuring half-lives, particularly the equilibrium and specific activity methods for long half-lives, and the use of electronic devices for measuring short half-lives are reviewed. 58 references.

1300 Primary and Secondary Meson Event in Photographic Emulsions, by Adair Morrison and Eric Pickup. Physical Review 74, p. 706-707, September 15, 1948.

Ilford nuclear research emulsions were exposed for 202, 187, 137, and 15 hours above 10,000, 15,000, 18,000, and 20,000 feet, respectively. In the 1000 cosmic ray stars yielded, one double meson event (π-μ-process) in which the secondary meson lies wholly in the emulsion was noted. In this event the primary meson enters through the surface and passes downward for 42 microns. The secondary meson travels upward through the emulsion and is scattered downward about 50 microns from the end of its range. The ranges of the primary and secondary meson as measured in horizontal projection are 176 and 627 microns, respectively. A profile is shown. After proper corrections, the ranges of the primary and secondary meson become 213 and 655 microns, respectively. A mosaic of photomicrographs of the tracks is shown.

1301 Stray-Radiation Measurement with X-Ray Film, by Adair Morrison. Nucleonics 3, No. 3, p. 46-54, September 1948.

This is a general discussion concerning the precautions and methods used in employing X-ray films to measure small quantities of radiation down to 0.05 roentgen exposures. A typical exposure-distance table and calibration graph is shown.

NUCLEAR PHYSICS - METHODS OF MEASURING

1302 Tracks of Low Ionizing Particles in Photographic Emulsions, by J. Spence, J. Castle, and J. H. Webb. Physical Review 74, p. 704-705, September 15, 1948.

Microphotographs of electron and meson tracks are given illustrating the extreme sensitivity of photographic emulsions for registration of charged particles. It is noted that photographic emulsions have been pushed to a point in sensitivity where they will register a particle of twice the energy loss rate of the minimum for any charged particle whatsoever. Mesons of 40 Mev energy should be recorded by the highest sensitivity emulsions now available. The longest electron track reported had a range of approximately 56 microns in the emulsion, corresponding to an electron energy of about 100 Kev. The longest meson track reported is 400 microns in length, corresponding to an energy of 3.6 Mev (assuming the mass of the meson = 313 electron masses).

NUCLEAR PROPERTIES

1303 The Liquid-Drop Model for Nuclear Fission, by R. D. Present. Nucleonics 3, No. 3, p. 25-31, September 1948.

The liquid-drop model explanation of the fission mechanism, based on an analogy between certain atomic nuclei and corresponding properties of ordinary matter in the liquid state, is reviewed here. The clear and simple picture of the nuclear fission mechanism presented by this model is emphasized, as is the successful prediction of the activation energy for fission and the lifetime against spontaneous fission. The model is unable to account for the observed assymetry of fission. 9 references.

1304 Some Observations Concerning the Energy of Nuclei, by E. Glueckauf. Proceedings of the Physical Society 61, Part 1, No. 343, p. 25-33, July 1, 1948.

The α-binding energy as a function of the number of neutrons and protons is shown to exhibit sharp fluctuations which occur at more or less regular intervals. There is evidence that these "kinks" are caused by discontinuous changes in the density and radius of the nuclei. It is shown that a mathematical connection exists between "kinks" in the α-binding energy curve and the irregularities of the β-stability line (Gamow valley), so that both must occur in the same region of the nuclei. This applies also to the irregularities in the mass-defect curve. A study is made of the energies of β-decay of isobaric nuclei in the region of the radioactive elements. The results are presented in tables.

NUCLEAR THEORY

1305 The Lifetime of the Heavy Meson, by J. Reginald Richardson. AECD-2308 (UCRL-169), August 26, 1948, decl. September 24, 1948. 3 p. For publication in Physical Review, as a letter to the editor.

This investigation indicated that the half-life of the star-producing negative mesons for $\pi \rightarrow \mu$ decay is $(5.7 \pm 1.1) \times 10^{-9}$ seconds.

1306 A Tentative Explanation of the Observed Mass of Mesons and Other Particles, by E. G. Cullwick. Physical Review 74, p. 707-708, September 15, 1948.

The experimental determination of rest masses of elementary particles intermediate in range between the mass of the electron and that of the proton is interpreted non-relativistically as a true conversion of energy into mass. Instead of using the usual laboratory reference system, the velocity of the particle is measured relative to that of the parent body in a Newtonian scheme. The laboratory

NUCLEAR THEORY

velocity of the particle, being the vector sum of the velocity of the parent body relative to the laboratory and the velocity of the particle, will vary with the direction of emission of the particle. This variation will be appreciable only when the velocity of the parent body relative to the laboratory is comparable with the velocity of light. In such cases the particles emitted in a forward direction will have the maximum laboratory velocities, while the converse will be true for those emitted in a backward direction. The variation in mass is interpreted as due to an apparent, rather than an actual, variation in velocity of the particles emitted at various angles. A particle having the same mass in all reference systems can thus be interpreted as having a variable mass, or it may be described on the basis of laboratory velocities as several different particles differing only slightly in mass. The excess of mass is regarded as the storage of part of the energy which has been expended in giving the particle its high velocity relative to its original inertial system.

NUCLEAR TRANSFORMATION

1307 Evidence for a p,d Reaction in Carbon, by Wolfgang K. H. Panofsky and Robert Phillips. AECD-2304 (UCRL-160), July 21, 1948, decl. September 21, 1948. 5 p. For publication in a technical journal.

The high energy behavior of the reaction $C^{12}(p,pn)C^{11}$ is taken as evidence for the ideas of Serber (Physical Review, 72, p. 1114, 1947) explaining these processes by a direct knockout, rather than a compound nucleus process. In this experiment, excitation curves of the reaction were obtained in the region from threshold to 32 Mev using the Berkeley linear accelerator. Stacks of polystyrene (C_nH_n) foils were bombarded in the beam of the accelerator. The β^+ from C^{11} were counted in standard geometry in a thin-window Geiger-Müller counter and compared with a UO_2 standard sample; the resultant curve is shown. The absolute cross sections were obtained by bombarding a foil at 32 Mev in vacuo and collecting the protons in a Faraday cup.

If the incoming proton were captured by the C nucleus, the resultant excited N^{13} would strongly favor the reemission of a proton over the emission of a deuteron or neutron. The cross section of the p,d reaction by a compound nucleus process should be much smaller than the values observed. The process is therefore likely to take place by a direct interaction, e.g., by direct ejection of a deuteron and subsequent decay of proton unstable N^{12}.

1308 Nuclear Photoeffect on Carbon Producing the Emission of Alpha Particles (Kernphotoeffekt an Kohlenstoff unter Aussendung von Alphateilchen), by H. Hänni, V. L. Telegdi, and W. Zünti. Helvetica Physica Acta 21, p. 203-204, 1948. (In German)

Photographic plates, exposed to hard γ-rays, show a number of stars formed by three α-particles produced from C^{12}. A statistical survey of the energy released reveals two main, energy groups, one at approximately 10.1 Mev, the other at 7.5 Mev. Both groups are due to the reaction $C^{12} + h\nu = 3\,He^4$. The reaction seems to go through two steps: $C^{12} + h\nu = Be^{8*} + He^4$, and $Be^{8*} = He^4 + He^4$. The first equation represents a nuclear photoeffect with the emission of an α particle.

PARTICLE ACCELERATORS

1309 A 20-Mev Betatron, by W. Bosley, J. D. Craggs, D. H. McEwan, and J. F. Smee. Journal of the Institution of Electrical Engineers 95, Part I, p. 352-358, August 1948.

The authors give a very detailed theoretical and practical discussion of the construction and operation of the 20-Mev betatron. Diagrams of circuits and connections, operating characteristics, and pictures of the machine are also given, as is a complete description of the vacuum system, expander and injector circuits, and magnetic field measurements. 22 references.

PHYSICS, GENERAL

1310 Heat Transfer in Stable Film Boiling, by LeRoy Alton Bromley. AECD-2295 (UCRL-122), June 2, 1948, decl. September 22, 1948. 79 p. For publication in Chemical Engineering Progress.

Equations, which are derived from a few simple premises and well verified by extensive experimental data, are used to calculate coefficients of heat transfer to be expected in natural-convection stable-film-boiling from a horizontal tube. The method employed for the derivation may be applied to derive equations for heat transfer coefficients to be expected in film boiling from any other shape. Equations are derived for the case of film boiling from a vertical tube or a vertical plane surface. 25 references.

1311 The Magnetic Susceptibility of BeO, by Clyde A. Hutchison, Jr. AECD-2322 (ANL-HDY-553), February 1948, decl. September 28, 1948. For publication in Physical Review.

The Guoy method was used to measure the magnetic susceptibility of BeO powder. The lack of appreciable variation of susceptibility with field strength and the results of spectrographic analysis indicate that the measurements were made on a quite pure sample. The gram magnetic-susceptibility was found to be -0.477×10^{-6}. The value, -11.93×10^{-6}, of the molal susceptibility is in relatively good agreement (4.7% deviation) with the value -11.39×10^{-6} which results from the calculation of the sum of the susceptibilities of Be^{+2} and O^{-2} using Angus's modification of Slater's screening constants for determining the mean squares of the orbital radii.

1312 The Surface Tension of Potassium, by Lloyd A. Quarterman and William Primak. AECD-2327 (ANL-HDY-545), August 13, 1948, decl. September 28, 1948. 2 p. For publication in Journal of the American Chemical Society.

This document is not an abstract; it is reproduced below in its entirety.

The surface tension of potassium reported in the literature is 411 dynes/cm (Quincke, Annalen der Physik 135, p. 621, 1868). In connection with some experiments on extremely pure potassium we have measured the capillary rise of potassium in pyrex glass and have obtained a considerably lower value for the surface tension.

Commercial C. P. potassium was cleansed of oil by Washing in petroleum ether and drying in a stream of helium. The potassium was then introduced into a high vacuum still by melting it and passing it through two constrictions. It was then refluxed for an hour, double distilled in high vacuum, and sealed off in the surface tension apparatus, similar to the one described by Richards and Coombs (Journal of the American Chemical Society 37, p. 1670, 1915). Prior to the final distillation, the surface tension apparatus was baked out at 52°C in high vacuum ($<5 \times 10^{-6}$ mm of Hg) for some hours. After the baking-out operation, a slight brown discoloration was observed in the glass. Potassium on being distilled into the apparatus wetted the glass immediately with a low contact angle and exhibited a capillary rise. The capillary rise was measured at several temperatures. Some of the values for a capillary bore of 0.038 on radius are as follows:

Temperature (°C)	62	75	98	109	129	135	145	153
Capillary Rise (cm)	5.43	5.46	5.52	5.54	5.54	5.59	5.61	5.57

A small correction should be added (0.1 – 0.2 cm) since the measurements were made from the top of the meniscus. If the surface tension is calculated with the usual equation assuming a low contact angle and using the densities of potassium given in the International Critical Tables (Vol. II, p. 463), one obtains about 86 dynes/cm, with no temperature variation within the precision of the experiments.

Since this work was performed, it was learned that more elaborate measurements are being made at the Naval Research Laboratory (R. R. Miller, Private communication), but the results have not been available to the authors.

QUANTUM MECHANICS

1313 The Method of Perturbations in the Theory of Quantum Fields, and the Construction of Heisenberg's S Matrix (La Méthode des Perturbations en Théorie des Champs Quantifiés et la Construction de la Matrice S de Heisenberg), Jean Pirenne. Helvetica Physica Acta 21, p. 226-232, 1948. (In French)

Starting with the Schrödinger equation, a method is developed for the Heisenberg S Matrix. The theory of perturbations has been established for the case of diffusion of point mesons through a nucleon. It was assumed, in the analysis, that there is no antinucleon, and that the mesons have a whole spin such that the elementary process of interaction between meson and nucleon is the emission or absorption of a single meson by the nucleon.

RADIATION SICKNESS

1314 Heparinemia; on Anticoagulant in the Blood of Dogs with Hemorrhagic Tendency after Total Body Exposure to Roentgen Rays, by J. Garrott Allen, Margaret Sanderson, Mary Milham, Alice Kirschon, and L. O. Jacobson. Journal of Experimental Medicine 87, p. 71-85, January 1, 1948. (See also MDDC-836).

When the entire body of dogs was exposed to 450 units of Roentgen irradiation a hemorrhagic syndrome developed which was characterized by thrombocytopenia, prolonged clotting bleeding times, and neutropenia. The prothrombin time remained normal until about 24 hours before death. The calcium, phosphorus, and magnesium levels were not altered. Fibrinogen was present but syneresis was poor.

Toluidine blue and protamine sulfate, substances which can inhibit the biologic action of heparin, restored the clotting time to normal. The hemorrhagic state was not materially altered by transfusions, vitamin K, or vitamin C. Toluidine blue and protamine sulfate were ineffective in the control of hemorrhage produced by dicumarol. The defect responsible for bleeding after irradiation appeared to be the presence in the circulation of an anticoagulant whose properties, so far as tested, were indistinguishable from those of heparin. 15 references.

1315 The Use of Adrenal Cortical Hormone in Radiation Sickness, by Friedrich Ellinger. Radiology 51, p. 394-399, September 1948.

In the light of recent studies radiation sickness appears to be caused by a general intoxication brought on by tissue decomposition products of histamine-like substances, or histamine itself, and adrenal cortical insufficiency. An important accompanying condition is the fact that there are fatty changes in the liver. Since a synthetic hormone of the adrenal cortex, desoxycorticosterone acetate (DCA), is known to counteract mineral losses caused by adrenal-cortical insufficiency and to play an important part in the inactivation of histamine, it seemed logical to use DCA in the treatment of radiation sickness. In an earlier series of tests (Science 104, p. 502, 1946; Radiology 50, p. 234-242, 1948) the author gave mice varying doses of total body irradiation and found that DCA protects the liver against radiation-induced fatty changes and that this liver-protecting action is accompanied by a decrease in the mortality rates.

Here the author has extended his studies on the influence of DCA on the effect of x-rays to include the effects on the spleen, bone marrow, and adrenal cortex. One hundred Swiss white mice (average weight 25 g) were exposed to 500r/air of X-rays (h.v.l. 0.75 mm Cu) given as total body irradiation in one exposure. Part of the animals were given daily doses of 0.5 mg DCA. They were killed at different intervals and the tissues examined histologically. The irradiation changes in the spleen were not affected by the hormone. However, there were well defined changes in the marrow observable in the DCA group, and there was a decreased depletion of the sudanophile fat in the adrenal cortex during the first week only. This seems to be explainable by the fact that cortical fat content had returned to normal. The lack of observable change in the spleen may have been factual, or the result of faulty method. The conclusion is made, taking other studies into consideration also, that the administration of DCA prevents exhaustion of the adrenal cortex caused by irradiation. Mention is made of a clinical study by the author and others on a group of 50 patients under treatment for radiation sickness where 37 patients were relieved of nausea and/or vomiting upon administration of DCA. 33 references, 2 figures.

RADIOACTIVITY

1316 The 4n + 1 Radioactive Series: The Decay Products of U^{233}, by French Hagemann, L. I. Katzin, M. H. Studier, G. T. Seaborg, and A. Ghiorso. AECD - 2300 (CB-3692), October 28, 1946, decl. September 22, 1948. 39 p. For Inclusion in NNES. (See also MDDC - 1186; Physical Review 72, p. 252, August 1, 1947)

The path of the decay chain between the isotopes U^{233} and Bi^{209} is traced and the properties found for the isotopes which are members of the chain are given. The findings may be summarized as follows:

$$U^{233} \xrightarrow{\alpha} Th^{229} \xrightarrow{\alpha} Ra^{225} \xrightarrow{\beta^-} Ac^{225} \xrightarrow{\alpha} {}_{87}^{221} \xrightarrow{\alpha} {}_{85}^{217} \xrightarrow{\alpha}$$

$$Bi^{213} \xrightarrow{96\%\ \beta^-} Po^{213}$$

$$Bi^{213} \xrightarrow{4\%\ \alpha} Tl^{209} \xrightarrow{(\beta^-)} Pb^{209} \xrightarrow{\beta^-} Bi^{209}$$

A document consisting of a table listing the nuclear properties of the decay products of this series has been given the number MDDC - 1186. Graphs are included. 29 references.

1317 Artificial Collateral Chains to the Thorium and Actinium Families, by A. Ghiorso, W. W. Meinke, and G. T. Seaborg. Physical Review 74, p. 695-696, September 15, 1948.

This letter to the editor is based upon AECD - 2166 which has been previously abstracted. See abstract No. 835.

1318 The Beta- and Gamma-Rays of Rb^{86}, by Daniel J. Zaffarano, Bernard D. Kern, and Allan C. G. Mitchell. Physical Review 74, p. 682-686, September 15, 1948.

The beta- and gamma-rays of Rb^{86} (19.5 d) have been measured in a magnetic lens spectrometer. Measurement of the energies of photoelectrons produced in a lead radiator shows one line corresponding to a gamma ray of energy 1.081 Mev. The beta-ray spectrum is resolvable into two groups with end point energies of 1.822 and 0.716 Mev. Gamma- and beta-ray spectra of Rb^{86} are shown, as is a Fermi plot of the Rb^{86} beta-ray spectrum and the Rb^{86} disintegration scheme.

1319 Cloud-Chamber Observations of the Decay of Tritium, by W. J. Byatt, F. T. Rogers, Jr., and Arthur Waltner. Physical Review 74, p. 699, September 15, 1948.

Beta-particle tracks from the decay of H^3 were observed in a cloud chamber; 1565 tracks were acceptable and the differential distribution of the projection length is shown. The maximum observed track length was 4.12 mm (referred to dry air at 15°C and 760 mm), which yields an energy of 11 ± 1 Kev as the corresponding maximum energy for the tritium beta particles.

1320 Cloud-Chamber Observation on Low Energy Portion RaE Beta-Spectrum, by Arthur Waltner and F. T. Rogers, Jr. Physical Review 74, p. 699-700, September 15, 1948.

Cloud chamber measurements were made of the low energy portion of the continuous beta spectra of RaE (Bi^{214}) using two different methods of depositing the RaE. The first method used a collodion film having a thickness of about 0.15 microns, and 716 tracks were observed. The second method used an electrolytically deposited source on a platinum wire to exhibit the effects of a massive source support, and 262 tracks were observed. Differential distribution curves are given for both methods. It is clear that the energy distribution of the RaE beta particles seems to vanish at zero (or some small energy); this result has not been reported previously.

RADIOACTIVITY

1321 The Half-Life of C^{14}, by R. C. Hawkings, R. F. Hunter, W. B. Mann, and W. H. Stevens. Physical Review 74, p. 696, September 15, 1948.

The half-life of C^{14} was determined using $C^{14}O_2$ and gas counters similar to those described by Miller (Science 105, p. 123, 1947) and Brown and Miller (Review of Scientific Instruments 18, p. 496 1947). The value arrived at was 6400 ± 200 years. Other investigators have arrived at values ranging from 4700 to 6100 years.

1322 The Half-Life of C^{14}, by L. Yaffe and Jean M. Grunlund. Physical Review 74, p. 696-697, September 15, 1948.

The half-life value of 7200 ± 500 years for C^{14} was determined by using a calibrated end-window Geiger counter.

1323 Internal Conversion Pairs in Carbon, by C. B. Dougherty, W. F. Hornyak, T. Lauritsen, and V. K. Rasmussen. Physical Review 74, p. 712, September 15, 1948.

The electron pairs produced by the internal conversion of the 3.11 Mev gamma radiation from the reaction C^{12} (d,p)C^{13*} were observed, using a magnetic lens spectrometer equipped with helical baffle system so that negative and positive spectra could be separately studied. Curves of the secondary electron distribution are shown, and the identification of a rise in both the electron and positron distribution curves with pair conversion of the 3.11 Mev gamma radiation is established. The cross section for pair production is of the order of 10^{-3} pair per gamma quantum.

1324 On the Positive Particles Occurring from P^{32} in the Cloud Chamber, by J. S. Barlow and F. T. Rogers, Jr. Physical Review 74, p. 700, September 15, 1948.

A number of stereoscopic pictures were taken of the tracks arising from a source of P^{32} mounted between two films of collodion in an air-filled cloud chamber in order to determine if the ratio of occurrence of "positive" tracks from beta emitters is dependent on the type of source mount used for the active material in the chamber. A total of 1493 pictures was taken and 7240 electron tracks versus 11 positive tracks (ratio = 0.15×10^{-2}) were observed. The ratio agrees with results of Pi and Chao (Physical Review 72, p. 639, 1947), and it would thus appear that the behavior of the positives is not dependent on the nature of the source support used. A method is suggested for investigating the discrepancy between cloud chamber results and results of other methods in determining the ratio.

1325 Some Measurements of Gamma-Ray Energies, by Franz N. D. Kurie and M. Ter-Pogossian. Physical Review 74, p. 677-682, September 15, 1948.

To examine the possibility that some radioisotopes which have been considered to decay by K-capture do in part decay with the emission of very slow positrons, careful measurements of the γ-rays emitted by two of them have been made. Preliminary measurements were made of the F and I lines of ThB (Pb^{212}) as a check on the spectrometer used. Also the annihilation radiation line of Cu^{64} was measured to establish its shape and position. In the course of this, good evidence was found for radiation resulting from annihilation while the positron is in flight. The weak high energy gamma ray previously reported was found and its energy determined to be 1.34 ± 0.01 Mev. The γ-radiation of both Be^{7} and Cr^{51} consists of a single line at 485 ± 5 Kev and 320 ± 5 Kev, respectively. No evidence of annihilation radiation was found in either case. Curves giving the momentum distribution of photoelectrons from a uranium radiator due to radiations from Cu^{64}, Be^{7}, and Cr^{51} are shown.

RADIOGRAPHY

1326 Formation of Optical Images by X-Rays, by Paul Kirkpatrick and A. V. Baez. Journal of the Optical Society of America 38, p. 766-774, September 1948.

Various possible methods for formation of optical images by X-rays are reviewed. A method employing concave mirrors seems to be the most promising. The theoretically possible resolving power is about 70 A; it is independent of λ. By causing the radiation to reflect from two concave mirrors in series, point images of points and extended images of extended objects may be produced. Sample pictures are given.

1327 Gamma-Ray Radiography in a Steel Foundry, by Robert A. Willey. Non-destructive Testing 6, No. 4, p. 15-18, Spring 1948.

The advantages of using gamma-ray radiography on specific production problems involving strut castings, gears, and gates are given.

1328 Radioactive Isotopes as Sources in Industrial Radiography, by Gerold H. Tenney. Non-Destructive Testing 6, p. 7-10, Spring 1948.

The author briefly discusses basic facts of atomic structure, transmutation in radium, half-life of radioactive elements, and production of radioactive isotopes by atomic bombardment. Preliminary experiments performed at Los Alamos using radioactive lanthanum, La^{140}, are reviewed. These experiments indicate that radioactive isotopes can be used as sources in industrial radiography. 9 references.

RADIOTHERAPY

1329 The Clinical Use of Radioactive Iodine, by Sidney C. Werner, Edith H. Quimby, and Charlotte Schmidt. Bulletin of the New York Academy of Medicine 24, p. 549-560 September 1948.

Radioactive iodine of 8-day half-life, I^{131}, has been used in tracer studies of iodine uptake by normal and disordered thyroid glands, and in the treatment of 40 cases of toxic goiter. Tracer uptake has diagnostic value, when stable iodine or anti-thyroid drugs have not been given shortly before this procedure. Normal uptake is 20-30 per cent of the administered tracer dose of 50-75 μc. Anything more than 40 per cent is regarded as definitely hyperthyroid, anything less than 10 per cent as hypothyroid.

Therapy has been successful in 30 of 34 cases after one, or when necessary two doses, with four failures. Six other treated cases did not respond to one dose, and have not been followed after a second long enough to draw conclusions. The cases of failure in the present series have been analyzed; they appear to be due to inadequate dosage, related mainly to the size of the gland. It is possible that an unusually high basal metabolic rate may also contribute to an unsatisfactory result. The complications following radioiodine therapy include sore throat, cough, tender gland, flare-up of toxicity, and transient hypothyroidism. Only a few cases of each have been observed; none of them was serious. Radiation hazards attendant on this therapy are analyzed; under the present conditions they are unimportant. 3 references.

1330 Hyperthyroidism and Pregnancy, by Robert D. Massey, Samuel F. Haines, and Emmerson Ward. American Journal of Obstetrics and Gynecology 55, p. 609-619, April 1948.

The recent literature concerning hyperthyrodism in pregnancy is reviewed. Reference is made to the use of radioiodine to treat hyperthyroidism in pregnancy. The authors have not used radioiodine themselves and suggest that more should be learned of the possible effects of radioiodine before generally accepting it for use.

RADIOTHERAPY

1331 Radioactive Isotopes in Medicine (Los Isotopos Radiactivos en Medicina), by Domingo Pescuma. Semana Medica 15, No. 2850, p. 391-401, August 26, 1948. (In Spanish)

This review of the role of radioactive isotopes in medicine contains a description of their preparation and a discussion of their present day application in biology and medicine (experimental and clinical). The article also contains a number of photographs showing the preparation of radioactive isotopes, the Harvard cyclotron, the Van de Graaff generator at Massachusetts Institute of Technology, etc. 17 references (15 American, 1 French, 1 English).

1332 Radioactivity and Urinary-Tract Calculi, by David S. Cristol, Albert E. Bothe, and Paul W. Grotzinger. New England Journal of Medicine 239, p. 427-429, September 16, 1948.

In what appears to be the first recorded case of the removal of a radioactive calculus, a 56-year-old man suffering from polycythemia vera, a vesical calculus, and multiple prostatic calculi was first treated with radioactive phosphorus in an effort to bring the blood hematocrit within normal limits in preparation for the surgical removal of the calculi. Two doses, separated by a 5-month interval, of 6 millicuries and 10 millicuries were given orally. Seven months after beginning treatment the hematocrit appeared normal and the operation was performed. During this time the vesical calculus increased in size. After removal it was found to be markedly radioactive. A Geiger counter at a distance of 10 cm. gave a count of 2000 per minute. The prostatic calculi, which were not in contact with the urine and did not grow apparently during the period, were not radioactive.

Auto-radiographs made of the halved calculus showed a ring of intense blackening around the periphery. This ring represented deposited radioactive phosphorus. From the width of the ring it was possible to estimate the increase in size of the calculus during the period of treatment. This observation of these authors seems to indicate a worthwhile application of radioactive substances in the study of urinary-tract-calculi formation and an opportunity to observe the effects of various diets, such as the effect of acid diet on the formation of alkaline stones.

RARE EARTHS

1333 A New Naturally-Occurring Isotope of Dysprosium, by David C. Hess, Jr. and Mark G. Inghram. AECD-2321 (ANL-HDY-569), August 25, 1948, decl. September 28, 1948. 3 p. For publication in Physical Review.

The isotopic constitution of dysprosium has been determined with a mass spectrometer using techniques previously described (M. G. Inghram, R. J. Hayden, D. C. Hess, Jr., Physical Review 72, p. 967, 1947). Three separate chemical preparations of dysprosium oxide were used. All three samples showed ion currents at mass 156 present in amounts about 0.05 per cent of the total. This could only be explained by postulating a previously undetected naturally occurring isotope in dysprosium of mass 156.

1334 Cathodo-Luminescence Spectra of Indian Fluorites, by B. Mukherjee. Indian Journal of Physics 22, p. 221-228, May 1948.

Visible and ultraviolet cathodo-luminescence spectra of some chemically decomposed fluorites were studied. The activators for luminescence of the specimens were Sm, Dy, Eu, Er, Nd, Gd, and Tb. Sm was the chief activator for luminescence, while Pr presence could not be ascertained definitely. The Mn band is suppressed by the rare earth action. Tables are given showing the activators in the chemically decomposed specimens as well as the wave lengths observed in their spectra. It is seen that the color of the fluorites is not a function of the rare earths contained in them.

RARE EARTHS

1335 On the Thermogravimetry of Analytical Precipitates. XIV. Lanthanum Determination (Sur la Thermogravimétrie des Précipités Analytiques. XIV. Dosage du Lanthane), by Thérése Duval and Clément Duval. Analytica Chimica Acta 2, p. 218-221, July 1948. (In French)

The three methods proposed so far for the determination of lanthanum have been tested experimentally. They are the gravimetric determination of lanthanum in the form of hydroxide, oxalate, and oxinate. The oxide prepared from the hydroxide must be heated to at least 944° and that obtained from the oxalate to not less than 876°. The basic carbonate reaches almost constant weight between 700° and 800°. The oxinate should be kept at 130°. Pyrolysis curves of the lanthanum derivatives are shown.

1336 On the Thermogravimetry of Analytical Precipitates. XV. Cerium Determination (Sur la Thermogravimétrie des Précipités Analytiques. XV. Dosage du Cérium), by Thérése Duval and Clément Duval. Analytica Chimica Acta 2, p. 222-225, July 1948. (In French)

To determine cerium gravimetrically in the form of its derivatives, the following conditions must be observed. The peroxide must be ignited above 450°, the iodate at 40-45°, the sulfate between 277° and 845°, the hexacyanoferrate at 20°, the oxalate above 450°, and the oxinate between 128° and 233°. Pyrolysis curves of these derivatives are shown.

1337 On the Thermogravimetry of Analytical Precipitates. XVI. Neodymium Determination (Sur la Thermogravimétrie des Précipités Analytiques. XVI. Dosage du Néodyme), by Thérése Duval and Clément Duval. Analytica Chimica Acta 2, p. 226-227, July 1948. (In French)

In the gravimetric determination of neodymium, using the hydroxide and oxalate, the hydroxide should be heated to above 608° and the oxalate decahydrate to above 813°. The anhydrous oxalate can be weighed after heating between 290° and 350°. Pyrolysis curves are given for the above neodymium derivatives.

1338 On the Thermogravimetry of Analytical Precipitates. XVII. Samarium Determination (Sur la Thermogravimétrie des Précipités Analytiques. XVII. Dosage du Samarium), by Thérése Duval and Clément Duval. Analytica Chimica Acta 2, p. 228-229, July 1948. (In French)

In determining samarium gravimetrically from the hydroxides and oxalates, the following conditions must be observed. The hydroxide must be ignited above 813° and the oxalate above 800° to insure complete transformation to Sm_2O_3. Pyrolysis curves are given for the two samarium derivatives.

SCIENTIFIC RESEARCH

1339 Atomic Physics, by J. K. Bøggild. (In Humanities and the Sciences in Denmark During the Second World War, p. 201-204, Copenhagen, Ejnar Munksgaard, 1948)

The research carried out in Denmark between 1939 and 1945 is briefly reviewed. The investigations included work on a cyclotron, electromagnetic high-tension apparatuses, high voltage (900 Kev peak) x-ray installations, low voltage ion sources, β-particle spectrographs, high intensity mass spectrographs, and current integrators for measuring the ion beam in high-tension apparatus. Data were obtained in the fields of spectroscopy, nuclear level energies, radioactivity, and fission cross sections. 30 references.

SCIENTIFIC RESEARCH

1340 Theoretical Physics, by Niels Arley. (In Humanities and the Sciences in Denmark During the Second World War, p. 205-208. Copenhagen, Ejnar Munksgaard, 1948)

A review is given of the studies in theoretical physics carried out in Denmark during 1939-1945. The main subjects covered were: 1) theory of fission, 2) meson theory, 3) theory of cosmic rays, and 4) quantum theory. The main studies were carried out by N. Arley, N. Bohr, Møller, H. Holst, and St. Rozental. 32 references.

1341 France and the Atom. Electrical Times 114, p. 261-262, September 2, 1948.

This is a review of an article by M. Bertrand Goldschmidt in Le Monde Illustré. Three phases are planned in the French atomic energy program. The first phase is now under way and includes the construction of an atomic pile producing a few kw only, uncooled, and using heavy water. The second phase will be the conversion of this pile to one of several hundred kw with cooling. Radioelements, available for medical research, may be obtained from this. The third phase will be the building of a pile of several thousand kw which will have graphite as a moderator and will be air cooled. This may not be completed until 1952.

SPECTROSCOPY

1342 Configurations of the Low Terms of Ti II, by Henry Norris Russell. Physical Review 74, p. 689-690, September 15, 1948.

Series relations among the high even terms of Ti I afford conclusive evidence that the lower of the two ^4F terms in Ti II arises from the configuration d^2s, and the other from d^3.

1343 The Internal Intensity Ratio of H_α and of D_α, by Chao-Wang Hsueh. Physical Review 74, p. 670-676, September 15, 1948.

A Geissler-Wood discharge tube was designed for use as the light source of H_α or D_α line. The tube was cooled in liquid air under low pressure to reveal the fine structure of the spectral lines. Four different separations, 7.6, 7.8, 8.0, and 8.2 mm, were used in the Fabry-Perot interferometer. Ten spectroscopic plates were measured for H_α and ten others for D_α. The internal intensity ratio of H_α and of D_α was found to be 0.808 ± 0.004 and 0.803 ± 0.003, respectively, as compared to the theoretical value of 0.806. This study indicates that the experimental value of the intensity ratio between the two main component groups agrees with the theoretical value when pure hydrogen or pure deuterium gas is used in the discharge tube and the discharge is at its maximum intensity. Sketches are given of the tube and the deuterium gas generator. Photographs showing spectrograms of D_α, Cd, and Ne lines, and the microphotometer curves of the H_α and D_α lines are reproduced.

1344 Multi-Prism Spectrographs with Glass Optics [manufactured] by Carl Zeiss, Jena, by G. Hansen. Journal of the Optical Society of America 38, p. 759-766, September 1948.

A new Zeiss three-prism glass spectrograph with prism system of Foersterling's design is used in connection with a Littrow camera. The prism system is described and sketched in detail, pictures of the spectrograph are shown, and the construction is explained.

1345 Organic Quantitative Analysis Using the Geiger Counter X-Ray Spectrometer, by C. L. Christ, R. Bowling Barnes, and E. F. Williams. Analytical Chemistry 20, p. 789-795, September 1948.

The Norelco Geiger counter X-ray spectrometer was used for the quantitative analysis of organic systems. The apparatus is described, and a schematic drawing of the construction details of the reinforced scanning quadrant is given. The article contains diffraction patterns of several types

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of sodium penicillin, as well as a Norelco pattern of sodium penicillin G Cu (Ni filtered) radiation. A method for the determination of the crystalline content of sodium penicillin G samples, accurate to ± 2.5 per cent is given. The results of several samples are compared with those obtained by ultraviolet and infrared methods. The conclusion is that the method is valid for the analysis of organic materials, provided that the particle size distribution of the unknown is essentially that of the standards used in making up the working curve. 19 references.

1346 Some Effects of the Intrinsic Magnetic Moment of the Electron, by G. Breit. Physical Review 74, p. 656-663, September 15, 1948.

Effects of the magnetic moment of the electron of the six-vector type are calculated. According to the hypothesis followed here, the electron's behavior in the field of a nucleus is described only approximately as that of a point charge. More accurately, it behaves as a particle having mainly the properties of a point charge which are corrected by the addition of a small "intrinsic" magnetic moment. In the present note the purely empirical point of view of an intrinsic magnetic moment is followed without any attempt at a justification from the point of view of quantum electrodynamics which has been given by Schwinger (Physical Review 73, p. 415, 1948). Formulas are worked out for the effect on hyperfine structure, on the Landé g factor and the contribution to the Lamb-Retherford line shift (Willis E. Lamb and Robert C. Retherford, Physical Review 72, p. 241, 1947). The arrangement of the calculations is such as to have the same system for the ordinary hyperfine structure and the other effects. The finite rather than zero size of the nuclear current system is explicitly included in the formulas.

1347 The Spectral Emissivity of Iron and Cobalt, by H. B. Wahlin and Harry W. Knop, Jr. Physical Review 74, p. 687-689, September 15, 1948.

The spectral emissivity of iron and cobalt has been determined as a function of the temperature. Sharp, definite changes in the emissivity have been observed in iron at the A_3 and A_4 points and at the Curie temperature for cobalt. A gradual change takes place in cobalt in the region where, presumably, the cobalt structure changes from hexagonal to cubic. A decrease in the neighborhood of 1370°K has been observed for iron. Emissivity curves are given for iron (1100°K-1700°K), cobalt (1200°D-1450°K), and a 65 per cent cobalt, 35 per cent nickel alloy (1200°K-1400°K).

TRACER APPLICATIONS, RADIOACTIVE

1348 Radioactive Tracers, by Allen F. Reid and Adele S. Weil. AECD-2324 (A-3248), n.d., decl. September 17, 1948. 28 p. For inclusion in NNES.

Cyclotron preparation of radioactive tracers has been discussed with specific details as to target preparation, nuclear reactions and deuteron and neutron activation. Methods for the chemical isolation of radioactive tracers have been treated for cases in which maximum activity is desired and for cases in which high specific activity is desired. The emission analysis of tracer materials has been discussed, giving details concerning detection apparatus and absolute and relative activity measurements. Some of the problems for which radioactive tracer technique can be used have been indicated.

1349 Analytical Methods for Ruthenium, by R. Thiers, W. Graydon, and F. E. Beamish. Analytical Chemistry 20, p. 831-837, September 1948.

Using a small quantity of radioactive ruthenium from the Canadian Atomic Energy project, the authors evaluated critically the different steps in the assay for ruthenium. The distribution of ruthenium losses during the fire assay of ruthenium containing ores has been determined. A new procedure for parting the button which allows complete isolation of the ruthenium and its accurate gravimetric determination is discussed.

TRACER APPLICATIONS, RADIOACTIVE

1350 The Biologic Effect of Irradiation by Radioactive Iodine, by Bengt N. Skanse. Journal of Clinical Endocrinology 8, p. 707-716, September 1948.

The studies reported here on radioactive iodine (I^{131}) (8-day iodine) in doses which have been used as "tracers" had two main objectives: 1) to determine the minimal amount of radioactive iodine which may interfere with the normal function of the thyroid gland, and 2) to study the effects of irradiation by radioactive iodine on various known functions of the thyroid. This paper reports on the radiation effect I^{131} on the thyroid in respect to: 1) collection of radioactive iodine, 2) capacity for growth, 3) capacity to collect iodine (from food and water), 4) capacity to respond to thiouracil, and 5) capacity to respond to thyrotropic hormone.

Five-day-old cockerels were used. A determination of the thyroid collection curves for 0.5 microcurie, 1.0 microcurie, 10.0 microcuries, and 50 microcuries of I^{131} demonstrated that during the first 96 hours no physiologic change took place in the thyroid at any dose level. The earliest radiation effect was observed in the 50 microcuries group 144 hours after administration of the iodine. It is indicated that the thyroid does not retain a large dose as well as it does smaller ones for any length of time. The thyroids of chicks which had received 1 microcurie of I^{131} did not change in growth or iodine concentration, while in those which had received 10 microcuries and 50 microcuries, normal growth was significantly inhibited. There was a significant decrease in the iodine concentration in the 50 microcuries group but not in the 10 microcuries group.

The ability of the thyroid to respond to thiouracil was demonstrated in a group of chicks receiving it for the 10-day period before killing. Response was measured by the increase in thyroid weight 26 days after administering I^{131}. However, 38 days after they received I^{131}, there was no longer any response to thiouracil in the 50 microcuries group, and in the 10 microcuries group the response was not as marked as in the nonradiated controls.

It was shown that all irradiated animals responded to thyrotropic hormone as measured by increase in thyroid weight and loss of iodine 16 days after administration of I^{131}. At the 24-day interval a dissociation in response to the hormone was demonstrated by the 10 microcuries and 50 microcuries groups. In the 10 microcuries group a loss of iodine but no increase in thyroid weight was observed, while in the 50 microcuries group no effect on weight and a minimal iodine loss were observed. The conclusion is made that so-called "tracer" doses of I^{131} may alter normal functions of the thyroid and that these functions vary in their sensitivity to irradiation from this isotope. 5 figures, 3 tables, 4 references.

1351 The Collection of Radioactive Iodine by the Hyman Fetal Thyroid, by Earle M. Chapman, G. W. Corner, David Robinson, and R. D. Evans. Journal of Clinical Endocrinology 8, p. 717-720, September 1948.

In this study to determine the age at which the human fetal thyroid begins to function, pregnant women with organic disease that endangered their health were given tracer doses of radioactive iodine from 12 to 48 hours before operation. Nine intact fetuses obtained during the operations were fixed in formalin and sectioned longitudinally through the midline. Their ages ranged from 7 to 32 weeks. Tissues from one half were prepared for microscopic section, while those from the other half were macerated in 5% potassium hydroxide for Geiger counts. Radioautographs were not tried. The information obtained indicates that the human fetal thyroid does not take up iodine in the first twelve weeks of life. Increasing amounts are collected after the fourteenth week. It is concluded, assuming that radioactive iodine collection and functional activity are synonomous, that this method has approximated the age of physiologic activity of the human fetal thyroid. 7 references.

1352 Correlation of the Radioactivity of Suspensions of Tubercle Bacilli with their Turbidity, by A. Kaplan, J. Traum, and R. A. Bankowski. American Review of Tuberculosis 58, p. 102-111, July 1948.

Because the dosage of tubercle bacilli used in experimental and other studies has a very important bearing on the interpretation of results of animal inoculations, methods of estimating dosage have

received considerable attention. Most of the dosages given in the literature are expressed in terms of milligrams based upon the weight of tubercle bacilli from which as much moisture as possible is removed by blotting paper. This method is recognized as very variable. The production of radioactive tubercle bacilli made available a unique method for determining the amount of bacilli in a suspension. In this work the bacilli were grown in liquid media containing approximately one microcurie of radioactivity per cc.

After the bacilli had been produced, filtered, ground, and measured for radioactivity the following calculations were used: Let S = total radioactivity per cc; F = radioactivity per cc of filtrate after passing suspension through Gradocol membrane; B = radioactivity per mg of dehydrated bacilli; D = per cent of dehydrated residue in fresh bacilli. Then the mg of bacilli (dehydrated weight) per cc of suspension = (S - F)/B, and the mg of bacilli (fresh weight) per cc of suspension = (S - F)/B x 100/D.

Since not all laboratories have the special apparatus and radioactive salts necessary for this method, its use is dependent upon its applicability to equipment and materials available in most laboratories. To determine this applicability the weight of bacilli in suspension was determined from its radioactivity, and the concentration of the suspension was correlated with its turbidity. Turbidity was measured by a Cenco-Sheard Sanford photelometer, a Gates opacimeter, and McFarland nepelometer. It was found that the photelometer provides a convenient and reasonably accurate method for estimating the weight of acid-fast bacilli in suspensions. The Gates opacimeter was less consistent and accurate and is dependent to a large degree upon the sensitivity of the eyes of the observer. The McFarland nephelometer showed considerable variability and gave disappointing results. However, a correlation between McFarland reading and fresh weight of bacilli in a suspension was worked out. 11 references.

1353 The Metabolic Degradation in the Mouse of Dibenzanthracene Labeled in the 9 and 10 Positions with Carbon 14, by Charles Heidelberger, Martha R. Kirk, and Marion S. Perkins. Cancer 1, p. 261-275, July 1948. (See also AECD-1923).

In this paper evidence is presented to show that dibenzanthracene is metabolized in the body of the mouse into at least four substances. As yet these have not been finally identified. Degradation of the dibenzanthracene takes place in the liver and intestinal tract, and there may be other sites. Neoplastic tissue appears capable of the degrading action, whereas normal tissue is not. It is suggested that some of these changes may be produced as artifacts from dihydroxydibenzanthracene during isolation procedures in the experiments. Dibenzanthracene was found in tumors 6 to 8 months after their induction, but this does not throw any light on whether it is the true carcinogen or whether some metabolite is. The metabolic degradation appears mainly to be a detoxication process quite unrelated to the initiation of cancer. 14 references.

1354 The Path of Carbon in Photosynthesis: II. Amino Acids, by W. Stepka, A. A. Benson, and M. Calvin. Science 108, p. 304, September 17, 1948.

The method of paper chromatography was used for the determination of the amino acid constituents of the green algae Chlorella pyrenoidosa and Scenedesmus D-3 after exposure to $C^{14}O_2$. The amino acids identified corresponded to the 3- and 4-carbon amino acids. In the case of Scenedesmus, the radioactive amino acids photosynthesized within one minute by a preillumination of 10 minutes were aspartic acid, which was the predominantly radioactive product, alanine, which was found to be somewhat less labeled, and radioactive phenylalanine in small amounts. With $C^{14}O_2$ Chlorella photosynthesized a predominant amount of radioactive aspartic acid and an almost equal amount of alanine, while β-alanine and serine were found to be minor radioactive products. Dark (1 min) $C^{14}O_2$ fixation by preilluminated Chlorella (60 min) produced mostly radioactive alanine.

1355 Radioactive Antibodies. Journal of the American Medical Association 138, p. 133, September 11, 1948.

Pressman and Keighley of the California Institute of Technology, in searching for tagged antibodies better suited for in vivo study, coupled radioactive iodine (I^{131}) with organ-specific antibodies.

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They used an antikidney serum prepared by injecting a 10 per cent emulsion of blood-free rat kidneys intra-abdominally in rabbits. The serum, containing a solution of I^{131}, was dialyzed against 1 per cent sodium chloride until freed from uncombined iodine. The globulin fraction was separated out. It was determined that each antibody globulin molecule had about four radioactive iodine atoms combined with it. Rats were injected with 13 mg (1 cc) of the serum. Iodinated antiovalbumin or iodinated normal serum globulin were used for control tests. Two days later the rats were killed and the blood-free tissue was analyzed. In the test animals Geiger-Mueller counts were negative for the kidneys, brain, heart, and spleen, and showed that practically no radioactivity was acquired by the fixed tissues. The liver and lungs gave very low counts. However, in the test animals there was an extremely high concentration of radioactivity in the kidneys. The concentration in the liver, lungs and spleen was less than 25 per cent of the renal concentration. The counts for the other organs were extremely low or negative. It is assumed that the extrarenal deposit of the specific globulin is caused by minor antibodies in the antikidney serum against the endothelial tissue common to all organs. The proof that radioactive iodine is electively deposited in the tissues when combined with homologous antibodies opens up a wide field of speculative therapeutic interest. 6 references.

1356 Radioisotopes in Nutritional Trace Element Studies. Part I, by C. L. Comar. Nucleonics 3, No. 3, p. 32-45, September 1948.

This review presents the trace element problem and its application to studies in plant and animal metabolism. The availability of the most useful radioactive isotopes is discussed and listed in tabular form. Definitions and considerations of the dosages required for a given experiment are included. The techniques of measuring radioactivity are described and also the types of Geiger-Mueller counters employed. A detailed description is given of the various methods of preparing samp samples for the activity measurements and, finally, the health precautions to be taken are discussed in detail. The article contains 2 tables, 4 figures (photographs) and a bibliography (44 references).

1357 Some Aspects of Nuclear Chemistry, by H. J. Emeleus. London, Royal Institute of Chemistry of Great Britain and Ireland, 1947. 19 p.

This is the text of a lecture delivered in April 1946 before the Royal Institue of Chemistry. The author discusses briefly the recent advances in the study of nuclear reactions, the discovery of the neutron and of artificial radioactivity, the production and chemistry of the transuranic elements, fission product yields, and the application of radioactive materials available as tracers.

1358 A Study of the Histopathology and Physiologic Function of Thyroid Tumors, Using Radioactive Iodine and Radioautography, by Brown M. Dobyns and Beatrice Lennon. Journal of Clinical Endocrinology 8, p. 732-748, September 1948.

By using radioautography the affinity for iodine or function of thyroid adenomas was studied in 94 cases of nodular goiter. All patients were given an identical standard tracer dose of radioactive iodine (I^{131}) 24 to 72 hours before the operations in which the nodules together with an adjacent piece of thyroid tissue were removed. The adenomatous and the thyroid tissues were mounted on slides. Six radioautographs, each with a different exposure time, were made of each adenoma. From the data obtained it is concluded that: 1) the degree of function may be related to the degree of cellular differentiation of adenomas, with certain exceptions; 2) there are hyperplastic adenomas with cellular hypertrophy that are not hyperfunctioning but there are also hyperplastic adenomas that are not functioning; and 3) hyperfunctioning adenomas may exist with or without evidence of thyrotoxicosis and probably by their excessive activity suppress otherwise normal thyroid tissue. 12 figures, 24 references.

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1359 Ranges in Air and Mass Identification of Plutonium Fission Fragments, by Seymour Katcoff, John A. Miskel, and Charles W. Stanley. Physical Review 74, p. 631-638, September 15, 1948. (See also MDDC-812)

Determinations were made of the mean and extrapolated ranges in air of plutonium fission fragments for twenty individual masses between 83 and 157. Collimated fission fragments passing through air at 120 or 140 mm pressure were deposited, after being stopped by the air, on a series of fourteen thin lacquer films. These were analyzed radiochemically for individual fission products. The corrected activities were plotted against distance traversed by the fragments, yielding differential range curves whose widths at half-maximum were 11.7±1.3 per cent, independent of fragment mass. The activities found beyond each distance were plotted against distance giving integral range curves. Mean and extrapolated ranges were derived from these. In the light group the extrapolated ranges decrease from 2.90 cm (15°C and 760 mm) for mass 83, to 2.25 cm for mass 117; in the heavy group they decrease from 2.25 cm for mass 127, to 1.95 cm for mass 157. From the range-mass curve drawn for well-known masses, definite assignments of 92, 93, and 132 were given to 3.5-hr Y, 10-hr Y, and 77-hr Te, respectively. Highly probable assignments of 94 and 134 were given to 20-min Y and 54-min I, respectively. A table of extrapolated ranges in air at 15°C of plutonium fission fragments is shown.

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1360 Determination of the Density of UF_6 from the Sinking Temperatures of Glass Floats, by Harold J. Hoge and Martin T. Wechsler. AECD-2301, n.d., decl. September 21, 1948. 10 p. For publication in Journal of Chemical Physics or Journal of Research of the National Bureau of Standards.

By observing the temperature at which glass bodies were just equal in density to the liquid, the density of UF_6 was measured from the triple point (64.052°C) to 162.59°C. The density of the liquid at the triple point was found to be 3.630 g/cm^{-3}. Results of an earlier investigation are also reported. They confirm the later data, and lead to a value of 4.87 g/cm^{-3} for the density of the solid at 62.5°C.

1361 A Preliminary Investigation of the Spectra of Uranium Isotopes, by J. R. McNally, Jr. AECD-2302, n.d., decl. September 9, 1948. For publication in the program of the Optical Society of America.

This document is an abstract; it is reproduced below in its entirety.

A number of wavelength differences in the spectra of uranium isotopes has been previously reported. These differences have been correlated to the spectroscopic energy systems of U(I) and U(II) and are found to be two types: (1) a simple isotopic displacement arising from configuration-nucleus interaction, and (2) a complex isotopic displacement arising from perturbations between close-lying levels. Wave number shifts, as large as one wavenumber, are not uncommon between 235 and 238 lines, the shifts usually being toward the violet for the lighter isotope. The magnitude of shift in U(I) is generally of the order of 0.3 cm^{-1}, but ranges from 0.7 cm^{-1} to 1.5 cm^{-1} in U(II). Configurations involving the s^2 electron group show the largest isotope shifts indicating an additive type of interaction for the s electrons and the nucleus.

1362 The Reaction of Uranium Oxides with Sulfur Monochlorides, by Leo Brewer, AECD-2307 (UCRL-163), July 31, 1948, decl. September 21, 1948. 6 p. For publication in a technical journal.

Thermodynamic calculations are made on the reaction of uranium oxide with S_2Cl_2. They indicate that the reaction at 400-500°K will produce $UOCl_2$ if there is an excess of oxide and UCl_4 if there is an excess of S_2Cl_2.

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1363 The X-Ray Investigations of the Uranium-Hydrogen System: The Structure of UH_3, by R. E. Rundle, A. S. Wilson, and R. A. McDonald. AECD-2309, July 7, 1945, decl. September 15, 1948. 14 p. For inclusion in NNES.

The uranium-hydrogen system has been examined by X-ray diffraction. This study has revealed one cubic hydride (UH_3). Since the structure of the hydride is unrelated to the structures of any of the forms of the metal and the hydride has a definite composition, it is not an interstitial solid solution but a true compound. The solubility of hydrogen and metal in UH_3 are so slight that they do not affect the hydride spacing by more than 0.001 A.

The hydrides UH_3 and UD_3 have the following X-ray lattice dimensions and densities:

	A	ρ
UH_3	$6.6310 \pm .008$ A	10.92
UD_3	$6.620 \pm .002$ A	11.11

The structure of uranium hydride has been determined. The positions of the metal atoms in the simple cubic unit are: 2 U_I in (0 0 0) (1/2 1/2 1/2), and 6 U_{II} in (1/4 1/2 0) (3/4 1/2 0). 17 references.

1364 The Lower Oxidation States of Uranium in its Molten Tribromide, by C. D. Thurmond AECD-2311, September 28, 1945, decl. September 15, 1948. 12 p. For inclusion in NNES.

Experimental data obtained during the determination of conditions most favorable for the electrolytic reduction of uranium could be explained by assuming the presence of uranium in a lower oxidation state in molten uranium tribromide. Experiments were designed to differentiate between this and other possible explanations such as the formation of a metallic "fog" of uranium in the melt, or direct dissolution of metal in the molten salt. The results allowed the construction of a portion of the liquid-solid phase equilibrium diagram of the system U-UBr_3, which shows that uranium is soluble in its molten tribromide and that if lower halides do exist in the liquid phase, they are unstable in the solid phase.

1365 Note on the Solubility of Uranium Tribromide in Fused Salts, by C. D. Thurmond. AECD-2312, September 28, 1945, decl. September 15, 1948. 5 p. For inclusion in NNES.

The liquid-solid equilibria of the systems SrI_2 - UBr_3 and $SrBr_2$ - UBr_3 have been investigated by the method of thermal analysis and tentative temperature-composition diagrams constructed.

1366 Rate of Reduction of Water by UBr_3 and UCl_3, by C. D. Thurmond. AECD-2313 (CC-938), September 28, 1945, decl. September 15, 1948. 6 p. For inclusion in NNES.

The amount of hydrogen evolved in the reaction of uranium tribromide and uranium trichloride with water corresponds closely to that required for the oxidation of the uranium to the tetravalent state. The rate of reaction of the trihalides with water varies with the method of their preparation. Reaction is less rapid at 0°C than at room temperature for both salts. At 0°C the trichloride can be kept, even in saturated aqueous solution in contact with solid salt, with little oxidation for considerable lengths of time. Added hydrochloric acid increases the rate of oxidation of the trichloride.

1367 The Preparation and Properties of Some Mixed Uranium Halides, by J. C. Warf and Norman Baenziger. AECD-2314, n.d., decl. September 15, 1948. 17 p. For inclusion in NNES.

Compounds of tetravalent uranium containing two halogens have been prepared. Six combinations of the four halogens are possible, and at least one compound of each group was made. The two general methods of preparation used were (a) reaction of a uranium trihalide with a halogen of greater atomic

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methods of preparation used were (a) reaction of a uranium trihalide with a halogen of greater atomic weight and (b) interactions of two tetrahalides.

X-ray diffraction patterns were made in most cases and cooling curves of melts were made for the bromochlorides. Uranium monobromotrichloride was found to be tetragonal, isomorphous with the tetrachloride, but further replacement of chlorine atoms by bromine atoms (as in the dibromodichloride) caused increasing distortion. All of the compounds containing iodine were thermally unstable. A summary of the analytical methods is given.

1368 The Solubility of Uranyl Oxalate and the Existence of Undissociated Uranyl Oxalate in Solution, by G. C. Pimentel and F. R. Stevenson. AECD-2323, September 8, 1945, decl. September 15, 1948. 9 p. For inclusion in NNES.

The solubility of the solid, $UO_2C_2O_4 \cdot xH_2O$, was measured at various acid and uranyl nitrate concentrations. The results of the measurements prove the existence of the uranyl oxalate complex, $UO_2C_2O_4$, in solutions containing excess UO_2^{+2}.

1369 X-Ray Analysis of the Uranium-Carbon System, by R. E. Rundle, A. S. Wilson, N. C. Baenziger, and A. D. Tevebaugh. AECD-2325, n.d., decl. September 30, 1948. For inclusion in NNES.

The only uranium carbides found at ordinary temperatures are the monocarbides and the dicarbide. There is good reason to believe that the sesquicarbide, U_2C_3, is formed above 2000 °C but cannot be quenched to room temperature.

Uranium monocarbide is face-centered cubic, a = 4.951 A, with the sodium chloride structure. Uranium monoxide and uranium mononitride are isomorphous with the monocarbide, and oxygen and nitrogen can replace carbon in the monocarbide. Uranium dicarbide is body centered tetragonal with the lanthanum decarbide structure, as has been reported in the literature. The lattice parameters are: a = 3.52 A and c = 5.99 A. The solubilities of both uranium and carbon in uranium monocarbide must be small since the monocarbide spacing is not a function of composition. There is evidence for solubility of carbon in the dicarbide, but the solubility is not pronounced.

1370 The Fluorescence of Uranium Trioxide Hydrates, by Dwayne T. Vier, Melvin L. Schultz, and Jacob Bigeleisen. Journal of the Optical Society of America 38, p. 811-814, September 1948.

The fluorescence spectra of the hydrates of uranium trioxide are given in curves as well as in tables. The hydrates are fluorescent when exposed to ultraviolet light. Anhydrous uranium oxides show no fluorescence.

1371 The Magnetic Susceptibilities of Some Uranium (IV) Compounds, by Clyde A. Hutchison, Jr. and Norman Elliott. Journal of Chemical Physics 16, p. 920-926, September 1948.

The magnetic susceptibilities of $U(SO_4)_2 \cdot 3.26\ H_2O$, $U(C_2O_4)_2 \cdot 5\ H_2O$ and $U(C_5H_7O_2)_4$ have been determined using the Gouy method at a series of temperatures from the boiling point of liquid N_2 to 60 °C. The Weiss-Curie law is obeyed at temperatures above 195° K. The data indicate the presence of two 5f electrons in the ground state. The susceptibility of $Th(C_5H_7O_2)_4$ at room temperature has also been determined.

1372 Preparation and Radiation of U^{237}, by Lars Melander and Hilding Slatis. Physical Review 74, p. 709-711, September 15, 1948.

By a modification of a method (L. Melander, Acta Chemica Scandinavica 1, p. 169, 1947) used in earlier experiments (H. Slätis, Arkiv för Matematik, Astronomi och Fysik 35A, No. 3, 1947; Nature 160, p. 579, 1947) on U^{239} and Np^{239}, the uranium isotope U^{237} was concentrated. Beta-activity

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measurements on the concentration product indicate a yield of 15-25 per cent and a concentration factor of at least 500. These values are in accordance with those found for slow neutrons (L. Melander, Acta Chemica Scandinavica 1, p. 169, 1947). The beta spectrum of U^{237} is shown and discussed in detail. A table is given, listing the momentum, $H\rho$, the energy of the beta particles, the ionization work, the energy of the corresponding gamma quanta, and the origin of the lines. The half-life was found to be 6.63 ± 0.05 days. The β-spectrum of U^{237} is shown graphically.

VACUUM

1373 High Vacua Convention. Chemistry and Industry No. 36, p. 568, September 4, 1948.

The Society of Chemical Industry is sponsoring a convention on high vacua, to be held October 12-13, 1948. Among the papers to be presented are: General Principles of High Vacua, by S. Dushman; Application of High Vacua to Plastics, by J. C. Swallow and J. S. Gourlay; Application of High Vacua to Dehydration, by R. S. Morse; Application of High Vacua to Distillation, by R. S. Morse; Application of High Vacua to the Distillation of Fatty Oils, by E. W. M. Fawcett; Application of High Vacua to the Metallurgical Industry, by R. S. Stauffer; Developments Arising Out of Experiments on Vacuum Distillation, by C. R. Burch; High Vacua in Nuclear Physics and Atomic Energy, by M. L. E. Oliphant.